EXHIBIT A

James E. Taylor
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PRIOR EMPLOYER:

Dahlgren USA, Inc. *(Oct. 1963-Jan. 2000)*
1725 Sandy Lake Road
Suite 102
Carrollton, Texas 75006
(972) 245-0035

I was employed by Dahlgren USA, Inc., and its predecessors, for over thirty six (36) years during which time I had upper management responsibilities in Engineering, Research and Development, and Technical Sales. I served with Dahlgren Manufacturing from 1963-1984, Dahlgren International, Inc. from 1984-1989 and Dahlgren USA, Inc. from 1989-2000. I retired from Dahlgren USA, Inc. effective as of January 1, 2000. I am now retained on a part-time basis by Dahlgren USA, Inc. as a technical consultant primarily to complete an ongoing project concerning: off-line applications of low-viscosity liquids.

JOB EXPERIENCE:

Responsible for Dahlgren's entire patent and licensing program on all corporate products and involved in developmental design, testing and evaluation of Dahlgren's new products. Served as technical consultant and advisor to upper management relative to old and new products pertaining to the companies' business as a supplier of quality industrial machinery and equipment to the Graphic Arts Industry, worldwide. Reported directly to the President, Chairman of the Board and owner of Dahlgren Mfg. Co., Dahlgren International, Inc. and Dahlgren USA, Inc.

Provided technical support to Dahlgren's affiliates (Japan, Germany, United Kingdom, Canada, etc...) for technical inquires pertaining to incoming sales (esp. to Japan). Coordinated with Dahlgren's USA's Engineering and Manufacturing Departments to establish schedules to meet customer requirements. Intimate knowledge was required of all Dahlgren's Products and interworkings of the company with ability to communicate within the structure of the entire organization as related to worldwide activities of Dahlgren International, Inc.

Provided technical material for publication of all Dahlgren's Product Data Bulletins as well as product brochures.

Served on Dahlgren's Board of Directors for eight (8) years from 1974 to 1982.

During the first six (6) years at Dahlgren, I served as Chief Engineer with primary design engineering management responsibilities on sheet and web-offset press Dampening and Web Conditioning Systems; also Dahlgren's Liquid Application System (L.A.S.), for high-speed paper making and paper converting machinery. Was responsible for fit and function of the original Dahlgren Dampener Product as it was initially applied first for domestic use and then world-wide on new and used sheet and web-offset printing presses, regardless of size, age, speed, or manufacturer. All specifications for production design were originally set-up by me and /or under my supervision.

For the L.A.S. product, was responsible for Sales, Service and Engineering during the early development of this product and for approximately the first thirty (30) machines. The largest unit build to date (240 inches) was developed, sold and applied under my supervision. Served as special technical assistant to the founder of Dahlgren Mfg. Co. for several years. Product involvement has been on the following Dahlgren developments/products:

DAMPENERS:	Sheet and Web-Fed Presses (Offset and Di-Litho) Metal Decorator Presses Board Presses Forms Presses Duplicator Presses Coater/Dampener for Sheet Presses
COATERS:	Coater/Dampener Reverse Roll Silicon (Blade) Blanket (Single Anilox Roll W/Blade and 2 Roll) L.A.S. Special Off-Line Coating System
MOISTURIZERS AND DECURLERS:	L.A.S. Web Conditioner
PRESSES:	Hustler (4-Color Perfector)
INKERS:	(Keyless) Single Form Roll Commercial Newspaper (Offset, Di-Litho, Flexographic)
OTHER:	Duplicator, 2nd Unit Color-Head (Inker/Dampener) Saturator/Vacuum Dryer Oscillating Form Rolls/Self-Oscillating Rolls Dryers (I.R.) Dampening Fluid Evaporation Systems Hickey-Picker Skeleton Wheel

Have served in the following capacities for the past 36 + years: Chief Engineer, Division Manager, Manager of Special Projects, Manager of Research and Development, Director - Corporate Technical Development, and Vice President - Research and Development, Sales Administration and Technical Sales Manager.

Well over 125 patents (domestic and foreign) representing over 50 inventions, have been issued under my direction. Have worked with six (6) different patent firms on both Dahlgren developed and outside developed products.

Vought Corporation *(Jan. 1953-Oct. 1963)*
LTV Missiles and Aerospace Division

For nearly five (5) years, I served as a Tool Engineer, responsible for the design and development of production assembly and machine tooling for products relating to the Aerospace industry. Six (6) remaining years at LTV was spent in the Engineering Department, where I served as a Test Engineer in the Experimental Laboratories (structures group) for over three (3) years and then as a Senior Product Design Engineer in Production Design (Wing and Controls Groups).

United States Navy *(Feb. 1951-Oct. 1953)*

I served as an Aviation Structural Mechanic and Plane Captain ,for two years, on active duty in the United States Naval Air Reserve. (Total reserve service was for five (5) years from Feb. 1948 to Jan. 1953). Assignment was with a Fleet Aircraft Service Squadron (FASRON 701) at Miramar, California (home of the Navy's present "Top Gun" School) during the Korean War.

Mosher Steel Company *(Jan. 1949-Feb. 1951)*

Served in the Engineering Department of this company as a Structural Steel Detailer/Designer, with primary responsibilities for detailing structural steel framing (girders, beams and columns) for large commercial and industrial buildings and bridges.

EDUCATION:

Southern Methodist University, School of Mechanical Engineering
5 years (1958-1963)

University of Texas at Arlington, School of Mechanical Engineering
2 years (1947-1949)

MISCELLANEOUS:

Member of UTA and SMU Alumni Association, TAGA (Technical Association of the Graphic Arts), GATF (Graphic Arts Technical Foundation), PIA (Printing Industries of America), NPES (National

Association of Suppliers to the Printing and Graphic Arts Industries), Dallas Litho Club and Rolling Hills Church of Christ (DeSoto, Texas). Past member of the Research and Engineering Council of the Graphic Arts and Graphic Communications Computer Association. Served as deacon in the church for sixteen (16) years. Married for forty-nine (49) years and father of four (4) children.

Have represented Dahlgren in technical sales areas at virtually all major printing shows and exhibitions, since 1968 to date, in Dallas, Texas; Chicago, Illinois; Philadelphia, Pennsylvania; Los Angeles, California; New York, New York; Paris, France and Dusseldorf, Germany.

Have made numerous technical presentations to audiences of from 20 - 200 in number, in the United States, Moscow, Russia and Beijing, China; primarily in the areas of product development activities of the Dahlgren Company.

Hold twelve (12) US patents primarily in the area of metering and applying viscous and non-viscous liquids for hi-speed printing and coating applications.

References furnished upon request.

EXHIBIT B

BROCHURE INDEX

Tab No.	Description	
1	Dahlgren Coater Dampener	1978
2	Dahlgren - Dampener Division	Copyrighted 1981
3	IBC Blanket Coating System	1984
4	Dahlgren Coater Printer	1986
5	Dahlgren Presentation visuelle	1987
6	Oxy-Dry 2 Roll Blanket Coater	1987
7	Dahlgren - Product Data Dahlgren Blanket Coater	Approx. 1988+
8	Pictures of Rapidac Blanket Coater	Late 80's or early 90's
9	Dahlgren Product Data Bulletin	Approx. 1990
10	Dahlgrens New Lithoplus Coating System	Dated 1990
11	Dahlgren Lithoplus Coater	Dated 1990
12	Epic 3 Roll Coaters (Ctr./Dampener, Blanket and Web)	1991
13	PRI's PBC Plate/Blanket and PC Plate Coater	Early 1990s
14	Dahlgren Single Roll Coater	Approx. 1992
15	IVT Colordry, Inc. Blanket Coater	Est. early 90's
16	Dahlgren - The Greatest Performance In Printing	Early 90's
17	Dahlgren LithoPlus Coater	1995

Retraction System Designs

18	Retraction System Designs by James E. Taylor and D.R. Selby	1984-1985

PRIOR ART

1	U.S Patent No. 2,279,204 Printing Cylinder	*Metal Press Mfg.* John P.E. Neilson	04/07/42
2	U.S. Patent No. 2,320,523 Dampening Roll for Printing Presses	*The Chandler & Price Co.* Joseph F. Jirousek	06/01/43
3	U.S. Patent No. 2,333,962	Thomas A. Terry	11/09/43
4	CH 319962 Farbwerk füBuchdruck; Offset druck-und dergleichen Maschinen für Farbendruck	*Maschinenfabrik Winkler, Fallert & Co. AG* Paul Heimlicher	03/15/57
5	Great Britain Patent No. 924401 Improvements in or relating to Ink Supplying Means for Rotary Printing Machines	Ernest Arthur Timson	04/24/63
6	U.S. Patent No. 3,397,675 Coating Apparatus	*West Virginia Pulp & Paper Co.* John De Ligt	08/20/68
7	U.S. Patent No. 3,433,155 Mechanism for Applying a Coating to a Plate	*Harris Intertype Corp.* Robert K. Norton	03/18/69
8	U.S. Patent No. 3,536,006 Multicolor Rotary Offset Printing Press with Cylinder Interruption	*Vandercook & Sons, Inc.* James Burton Roozee	10/27/70
9	U.S. Patent No. 3,604,350 Flexographic Presses with Interrupter and Cylinder Register Mechanisms	Lawrence Rosenstadt	09/14/71

10	U.S. Patent No. 3,749,011 Damping Device for Lithographic Printing Presses	*Roland Offsetmaschinenfabrik Faber & Schleicher AG* Paul Abendroth, Hans Alix, Friedrich Preuss, Fred Kunkel	07/31/73
11	U.S. Patent No. 3,768,438 Machine for Coating Sheets of Paper and the like with Liquid Coating Materials	Wilhel Kumpf	10/30/73
12	U.S. Patent No. 3,800,743 Materials Application Apparatus	*Xerox Corporation* Raymond K. Egnaczak	04/02/74
13	U.S. Patent No. 3,916,824 Device for Coating Strip Material in Continuous Operations	*Aluminum Norf GmbH* Peter Knodel, Gerhard Mayer, Horst Munsterer, Reinbold Wagner	11/04/75
14	U.S. Patent No. 3,931,791 Mechanism for Applying Lacquers and the like on a Printing Press	*Roland Offsetmaschinenfabrik Faber & Schleicher AG* Friedrich Preuss and Kurt Difflipp	01/13/76
15	U.S. Patent No. 3,986,452 Liquid Applicator for Lithographic Systems	*Dahlgren Manufacturing Company, Inc.* Harold P. Dahlgren	10/19/76
16	DE 21 51 185 B2 Mechanism for Applying Laquers and the like on a Printing Press	*Maschinenfabrik Augsburg-Nurnberg AG* Hermann Fischer	07/19/79
17	U.S. Patent No. 4,165,688 Ink Dam for Printing Press	*Magna-Graphics Corporation* Dale D. Leanna and Allen R. Jorgensen	08/28/79
18	U.S. Patent No. 4,222,325 Mounting Means for Movable Carriage on an Offset Press	*White Consolidated Industries, Inc.* Robert Edwards	09/16/80
19	U.S. Patent No. 4,270,483 Printing Coater	Denton G. Butler and Andrew W. Lester	06/02/81

20	U.S. Patent No. 4,308,796 Offset Lithographic Press with Ink Metering System for Blanket Cylinder	*S-W-H Ltd.* William L. Satterwhite	01/05/82
21	U.S. Patent No. 4,372,244 Varnishing Units on Printing Presses	*M.A.N.-ROLAND Druckmaschinen AG* Herbert Rebel	02/08/83
22	U.S. Patent No. 4,379,039 Ultraviolet Curable Resin Composition	Toyo Boseki Kabushiki Kaish Hiroshi Fujimoto, Hideo Miyake	04/05/83
23	U.S. Patent No. 4,396,650 Primed Inorganic Substrates Overcoated with Curable Protective Compositions	*Minnesota Mining & Mfg. Co.* Roger W. Lange, Alek P. Szecsy	08/02/83
24	U.S. Patent No. 4,397,237 Roller Train Structure for use with Printing Machine	*M.A.N.-ROLAND Druckmaschinen AG* Manfred Makosch	08/09/83
25	U.S. Patent No. 4,399,767 Varnishing Unit in the Delivery Unit of a Sheet-Fed Rotary Printing Press	*M.A.N.-ROLAND Druckmaschinen AG* Claus Simeth	08/23/83
26	U.S. Patent No. 4,402,267 Method and Apparatus for Handling Printed Sheet Material	*Printing Research Corporation* Howard W. DeMoore	09/06/83
27	U.S. Patent No. 4,421,027 Multiple Printing Mode Printing Machine System	*M.A.N.-ROLAND Druckmaschinen AG* Hermann Fischer	12/20/83
28	U.S. Patent No. 4,423,677 Rotary Sheet Offset Printing Machine	*M.A.N.-ROLAND Druckmaschinen AG* Hermann Fischer	01/03/84
29	U.S. Patent No. 4,446,814 Device for Applying a Fluid, in Particular Lacquers on Printed Sheets or Continuous Webs	*M.A.N.-ROLAND Druckmaschinen AG* Paul Abendroth, Janko Despot	05/08/84

30	U.S. Patent No. 4,451,509 Radiation-Hardenable Aqueous Binder Emulsions of Acrylate Prepolymer with Unsaturated Polyester Emulsifier Having Benzyloxy and Alkylene-Oxy Groups	*Bayer Aktiengesellschaft* Walter Frank, Otto Bendszus, Jurgen Meixner, Hans J. Freier, Hans-Jaochim Traenckner	05/29/84
31	U.S. Patent No. 4,501,223 Coating Apparatus	*Hitachi Zosen Corporation* Sadayuki Matsuno, Hiroshi Itoh, Isamu Nishikawa, Tatsuo Awazu, Toshio Matsunaga, Yoshitaka Kitaoka, Goro Sugimoto, Hiroki Nishinaka	02/26/85
32	U.S. Patent No. 4,524,712 Varnish Coater for Printed Product	*Komori Printing Machinery Co., Ltd.*/Kiyoshi Ito	06/25/85
33	U.S. Patent No. 4,536,218 Process and Compositions for Lithographic Printing in Multiple Layers	Eli A. Ganho	08/20/85
34	U.S. Patent No. 4,569,306 Varnish Coater for Printed Product	*Komori Printing Machinery Co., Ltd.* Kiyoshi Ito, Tamotsu Omori	02/11/86
35	U.S. Patent No. 4,574,732 Overvarnish Unit	*Feco Engineered Systems, Inc.* William G. Verwey, John C. Hovekamp	03/11/86
36	U.S. Patent No. 4,586,434 Device for Replacing Plate Cylinders	*Rengo Co., Ltd.* Masateru Tokuno, Tetsuya Sawada Hidetoshi Hoshiyama Toshihiro Yoneda	05/06/86
37	U.S. Patent No. 4,615,293 Medium-Applying Device in a Printing Machine	*Heidelberger Druckmaschinen AG* Hans-Georg Jahn	10/07/86

38	U.S. Patent No. 4,617,865 Liquid Coater for a Printing Press with Moveable Inking Roller and Tray	*Ryco Graphic Mfg., Inc.* Thomas G. Switall	10/21/86
39	EP 0270 054 A2 Slip Sheet Insertion-Delivery Apparatus for Sheet-Fed Printing Press	*Komori Printing Machinery Co.* Toshio Hoshi	12/04/86
40	EP 0293 586 A2 Geteilter Farbkasten für eine Flexodruckmaschine	*M.A.N.- ROLAND Druckmaschinen AG* David J. Sarazen	05/29/87
41	U.S. Patent No. 4,685,414 Coating Printed Sheets	Mark A. DiRico	08/11/87
42	U.S. Patent No. 4,704,296 Web Coating Method and Apparatus	*Magna-Graphics Corp.* Dale D. Leanna, Eugene R. Wittkopf, Allen R. Jorgensen	11/03/87
43	U.S. Patent No. 4,706,601 Device for Applying Medium After Termination of Printing Operation in a Printing Machine	*Heidelberger Druckmaschinen AG* Hans-Georg Jahn	11/17/87
44	U.S. Patent No. 4,753,166 Printing Machine Ink Smoother	*M.A.N.- ROLAND Druckmaschinen AG* Hermann Fischer	06/28/88
45	U.S. Patent No. 4,779,557 Coater for a Sheet Fed Printing Press	Joseph Frazzitta	10/25/88
46	U.S. Patent No. 4,796,528 Separated Ink Fountain for a Flexographic Printing Machine	*M.A.N. - ROLAND Druckmaschinen AG* David J. Sarazen	01/10/89
47	U.S. Patent No. 4,796,556 Adjustable Coating and Printing Apparatus	*Birow, Inc.* John W. Bird	01/10/89

48	U.S. Patent No. 4,815,413 Varnishing Apparatus for Printed Sheet	*Komori Printing Machinery Co., Ltd.* Toshio Kota	03/28/89
49	U.S. Patent No. 4,821,672 Doctor Blade Assembly with Rotary End Seals and Interchangeable Heads	Nick Bruno	04/18/89
50	U.S. Patent No. 4,825,804 Vertically Retracting Coater	*Dahlgren International, Inc.* Mark A. Dirico, Phillip Rodriguez	05/02/89
51	U.S. Patent No. 4,841,903 Coating and Printing Apparatus Including an Interstation Dryer	*Birow, Inc.* John W. Bird	06/27/89
52	U.S. Patent No. 4,848,265 Printing Apparatus having Coating Function	*Komori Printing Machinery Co., Ltd.* Tatsuo Komori	07/18/89
53	U.S. Patent No. 4,852,515 Device for Automatically Controlling Coating Amount for Use in Coating Machine	*Chugai Ro Co, Ltd.* Yoshiyasu Terasaka, Masao Tanabe	08/01/89
54	U.S. Patent No. 4,882,991 Change-Over Inking Unit of a Sheet-Fed Rotary Press	*M.A.N. - ROLAND Druckmaschinen AG* Claus Simeth	11/28/89
55	U.S. Patent No. 4,889,051 Removable Inking Device for Offset Press	Jean-Claude Sarda	12/26/89
56	U.S. Patent No. 4,895,070 Liquid Transfer Assembly and Method	*Birow, Inc.* John W. Bird	01/23/90

57	U.S. Patent No. 4,919,048 Apparatus for Preventing Contact of Wet Ink Sheets with Printing Press Delivery Mechanisms and for Drying Said Wet Ink	Jack D. Tyler	04/24/90
58	U.S. Patent No. 4,934,305 Retractable Coater Assembly including a Coating Blanket Cylinder	*Dahlgren International, Inc.* Jamie E. Koehler, James E. Taylor	06/19/90
59	U.S. Patent No. 4,936,211 Multicolor Offset Press with Segmental Impression Cylinder Gear	*Presstek, Inc.* Frank G. Pensavecchia, Richard A. Williams, John P. Gardiner, Stephen M. Laponsey, John F. Kline	06/26/90
60	U.S. Patent No. 4,939,992 Flexographic Coating and/or Printing	*Birow, Inc.* John W. Bird	07/10/90
61	U.S. Patent No. 4,977,828 Transfer Roller Device for Printing Presses	*Printing Research, Inc.* David D. Douglas	12/18/90
62	GB 2263 438 A Printing Apparatus	*The Langston Company* Joseph John Weishew	01/22/92
63	U.S. Patent No. 5,088,404 Delivery Apparatus for Printing Press	Edward P. MacConnell, Shigeki Matsukawa	02/18/92
64	U.S. Patent No. 5,107,790 Two Headed Coater	*Rapidac Machine Corp.* Larry J. Sliker, Robert S. Conklin	04/28/92
65	U.S. Patent No. 5,127,329 Vacuum Tansfer Apparatus for Rotary Sheet-Fed Printing Presses	*Howard W. DeMoore* Howard W. DeMoore	07/07/92
66	U.S. Patent No. 5,176,077 Coating Apparatus for Sheet-Fed, Offset Rotary Printing Presses	Howard W. DeMoore, David D. Douglas and Steven M. Person	01/05/93

[redacted]			
67	U.S. Patent No. 5,178,678 Retractable Coater Assembly Including a Coating Blanket Cylinder	*Dahlgren International, Inc.* Jamie E. Koehler, James E. Taylor, Mark A DiRico	01/12/93
68	U.S. Patent No. 5,189,960 Apparatus and Method for Controlling Temperature of Printing Plate on Cylinder in Rotary Press	Fredric Valentini, David W. Moore	03/02/93
69	U.S. Patent No. 5,209,179 Liquid Coating Apparatus fot Use in Conjunction with Printing Presses Where Access of the Coating Apparatus to the Press Cylinders is Restricted	*Herbert Productions, Inc.* John C. Herbert, Frank A. Andaloro	05/11/93
70	EP 0647 529 A1 High Velocity, Hot Air Dryer and Extractor	*Howard W. DeMoore* Howard Warren DeMoore	10/06/93
71	U.S. Patent No. 5,335,596 Coating Apparatus for Sheet-Fed, Offset Rotary Printing Presses	*Howard W. DeMoore* Howard W. DeMoore, Steven M. Person	08/09/94
72	DE 4311 834 A1 Einrichtung zum Besshichten von Bedruckstoffen in Druckmaschinen	*M.A.N.-ROLAND Druckmaschinen AG* Georg Hartung, Ulrich Jung, Juergen Schneider	10/13/94
73	U.S. Patent No. 5,476,041 Printing Press Having a Device for Controlling the Air in a Sheet Feeder	*Heidelberger Druckmaschinen AG* Ernst Czotscher	12/19/95

EXHIBIT C

Table I: Matrix - "Retractable Liquid Application Systems"
(Coaters / Inkers)

(Patents and Brochures)

				Applicator		Mode		Press (1)					Accessibility			Where Applied				Liquid			Where On Press				Other
Patent Issue Date and Brochure Date	Patent Number	Inventor For Patents or Brochure	Brochure / Patent	Coater (2)	Inker (2)	In-Line	Off-Line	Offset	Flexo	Letterpress	Other	Retractable (3)	Fixed	Removable Unit	Removable Rolls	To Plate Cyl	To Blanket Cyl	To Impression	Photo Polymer Plate On Bl Cyl	Coatings	Inks	Other Liquid	Last Unit	Tower	Transfer Cyl.Conver.	Single Color	Interstation Drying
1943	962'	Terry	P3		AR	✓	✓			S			✓	✓		✓					✓					✓	
1971	350'	Rosenstadt	P9		AR		✓		W			H				✓		✓			✓						✓
1978	-	Dahlgren CD	B1	3R		✓		S					✓		✓	✓			✓	✓			✓				
1982	798'	Satterwhite	P20	AR	AR	✓	✓	SW					✓		✓		✓		✓	✓	✓	✓	✓				
1984	-	IBC	B3	2R		✓	✓	S				I					✓		✓	✓			✓				
1986	-	Dahlgren CP	B4	AR	AR	✓		S				H					✓		✓	✓	✓		✓				
1986	434'	Tokuno et al	P36		AR		✓				W		✓		✓	✓		✓			✓						✓
1986	865'	Switall	P38	2R		✓	✓	S				I					✓		✓	✓			✓				
1987	-	Oxy-Dry	B6	2R		✓	✓	S				I					✓		✓	✓			✓				
1987	414'	De Rico	P41	AR		✓	✓	S				H					✓		✓	✓			✓				
1988	757'	Frazzitta	P45	3R		✓	✓	S				T					✓			✓			✓				
1988	903'	Bird	P51	3R		✓		S				I/H					✓			✓			✓				✓
1989	558'	Bird	P47	3R		✓		S				I/H				✓	✓			✓			✓				
1989	804'	Di Rico et al	P50	AR		✓	✓	S				H/V					✓		✓	✓			✓				
1989	051'	Sarda	P55		L	✓		S				F					✓				✓					✓	
1990	-	Dahlgren LPC	B 10,11	AR		✓		S				I						✓	✓	✓			✓	✓	✓		
1990	305'	Koehler et al	P58	AR		✓		S				I						✓	✓	✓			✓				
1991	-	Epic BC	B12	3R		✓	✓	S				I					✓		✓	✓			✓				
1992	790'	Syiker et al	P64	3R		✓	✓	S				I,H				✓	✓		✓	✓				✓			
1992	077'	De Moore et al	P66	AR		✓		S					✓					✓	✓	✓			✓				
1993	678'	Koehler et al	P67	AR		✓		SW				I						✓	✓	✓		✓	✓	✓	✓		
1993	179'	Herbert et al	P69	AR		✓		SW				I/V						✓		✓			✓	✓			
1994	596'	De Moore et al	P71	AR		✓		S					✓					✓	✓	✓	✓		✓				
1984-1985	-	System Designs	S18	2R		✓	✓	S				*					✓		✓	✓			✓				
1987-90	-	Dahlgren BC	B 5,7,9	AR		✓	✓	S				H					✓		✓	✓			✓				
1989-1990	-	RAPIDAC	B8	3R		✓	✓	S				FB,I					✓		✓	✓			✓				
Early 90's	-	PRI	B13	3R		✓	✓	S				I/H				✓	✓		✓	✓			✓				
Early 90's	-	IVT	B15	3R		✓	✓	S				V, H/I					✓		✓	✓			✓				

Codes:

(1) S = Sheet-Fed; W = Web Fed
(2) AR = Single Anilox Roll With Blades or with Metering Roll; 2R = Two Roll; 3R = Three Roll, L=Litho
(3) I = Inclined; H = Horizontal; V = Vertical; F = "Ferris"; T = Transverse; FB = Four (4) Bar Linkage, X/Y = Combination
(*) Taylor Sketches = F, FB & V / H; Selby Sketches = V/H, I, FB & F

Prefix (P) = Patent Number
Prefix (B) = Brochure Number
Prefix (S) = Sketch

EXHIBIT D

TAYLOR EXHIBIT D

Claims of Serial No. 08/435,798
Filed May 4, 1995 - Pending as of Summer 2000

1. In a printing press of the type having side frame members forming a printing unit tower on which a plate cylinder and blanket cylinder are support for rotation, the improvement comprising:

inking/coating apparatus for applying ink or coating material directly to a plate mounted on the plate cylinder or directly to a blanket mounted on the blanket cylinder when the inking/coating apparatus is in an operative position; and

a carriage assembly including a support arm having a first end portion pivotally mounted to the printing unit tower and a second end portion pivotally mounted to the inking/coating apparatus, the carriage assembly being movable to an operative position in which the inking/coating apparatus is suspended laterally adjacent to the plate and blanket cylinders, and being movable to a retractable position in which the inking/coating apparatus is elevated with respect to the plate and blanket cylinders.

2. The invention as set forth in claim 1, wherein the inking/coating apparatus comprises:

a doctor blade assembly having a reservoir for receiving ink or liquid coating material;

an applicator roller coupled to the doctor blade assembly in fluid communication with the reservoir, the applicator roller being engagable with a printing plate on the plate cylinder of with a blanket on the blanket cylinder when the inking/coating apparatus is in the operative position.

3. The invention as set forth in claim 2, the applicator roller comprising: an anilox roller having a resilient transfer surface.

4. The invention as set forth in claim 1, including a counterweight coupled to the support arm.

5. The invention as set forth in claim 1, further comprising:

a power actuator pivotally coupled to the support arm, the power actuator having a power transfer arm which is extendable and retractable; and,

apparatus coupled to the power transfer arm for converting extension or retraction movement of the power transfer arm into pivotal movement of the inking/coating apparatus relative to the support arm.

6. In a printing press of the type having side frame members forming a printing unit tower on which a plate cylinder and blanket cylinder are support for rotation, the improvement comprising:

inking/coating apparatus for applying ink or coating material to a plate mounted on the plate cylinder or to a blanket mounted to a blanket cylinder when the inking/coating apparatus is in an operative position;

a carriage assembly including a support arm having a first end portion pivotally mounted to the printing unit tower and a second end portion pivotally mounted to the inking/coating apparatus, the carriage assembly being movable to an operative position in which the inking/coating apparatus is suspended laterally adjacent to the plate and blanket cylinders, and being movable to a retractable position in which the inking/coating apparatus is elevated with respect to the plate and blanket cylinders;

a power actuator pivotally coupled to the support arm, the power actuator having a power transfer arm which is extendable and retractable;

apparatus coupled to the power transfer arm for converting extension or retraction movement of the power transfer arm into pivotal movement of the inking/coating apparatus relative to the support arm;

the movement converting apparatus;

a bell crank plate having a first end portion coupled to the power transfer arm and having a second end portion for engaging a stop member;

a stop member secured to the inking/coating apparatus; and

a cleavis plate secured to the support arm and pivotally coupled to the bell crank plate.

7. The invention as set forth in claim 1, the inking/coating apparatus comprising:

an applicator head having first and second side frame members pivotally coupled to the carriage assembly;

a doctor blade assembly mounted between the first and second side frame members, the doctor blade assembly including a reservoir for receiving ink or liquid coating material;

cradle means mounted on the first and second side frame members, respectively;

an applicator roller mounted for rotation on the cradle means and coupled to the doctor blade assembly for rolling contact with ink or coating material in the reservoir, the applicator roller being engagable with a printing plate on the plate cylinder or with a blanket cylinder in the operative position; and

motor means coupled to the applicator roller for rotating the applicator roller.

8. The invention as set forth in claim 7,

the cradle means including first and second sockets disposed on the first and second side frame members respectively; and,

the applicator roller being mounted for rotation on the first and second sockets.

9. In a printing press of the type having side frame members forming a printing unit tower on which a plate cylinder and blanket cylinder are supported for rotation, the improvement comprising:

inking/coating apparatus for applying ink or coating material to a plate mounted on the plate cylinder or to a blanket cylinder mounted on the blanket cylinder when the inking/coating apparatus is in an operative position;

a carriage assembly including a support arm having a first end portion pivotally mounted to the printing unit tower and a second end portion pivotally mounted to the inking/coating apparatus, the carriage assembly being movable to an operative position in which the inking/coating apparatus is suspended laterally adjacent to the plate and blanket cylinders, and being movable to a retractable position in which the inking/coating apparatus is elevated with respect to the plate and blanket cylinders;

the inking/coating apparatus comprising:

an applicator heading first and second side frame members pivotally coupled to the carriage assembly;

a doctor blade assembly mounted between the first and second side frame members, the doctor blade assembly including a reservoir for receiving ink or liquid coating material;

cradle means mounted on the first and second side frame members, respectively;

an applicator roller mounted for rotation on the cradle means and coupled to the doctor blade assembly for rolling contact with the ink or coating material in the reservoir, the applicator roller being engagable with a printing plate on the plate cylinder or with a blanket on the blanket cylinder in the operative position; and

motor means coupled to the applicator roller for rotating the applicator roller;

the cradle means including first and second sockets disposed on the first and second side frame members, respectively, and third and fourth sockets disposed on the first and second side frame members respectively;

the applicator roller being mountable for rotation on the first and second sockets for applying ink or coating material to the plate when the carriage assembly is in the operative position; and

the applicator roller being mountable for rotation on the third and fourth sockets for applying ink or coating material to the blanket when the carriage assembly is in the operative position.

10. The invention as set forth in claim 1, comprising:

male and female latch coupling members mounted on the carriage assembly and on the printing unit tower, respectively, for releasably latching the carriage assembly in interlocking engagement with the printing unit tower in the operative position.

11. The invention as set forth in claim 1, wherein the support arm comprises an elongated shank portion and a hub portion which extends transversely with respect to the shank portion, the elongated shank portion being pivotally coupled to the inking/coating apparatus and the hub portion being pivotally coupled to the printing unit tower.

12. A sheet fed, rotary offset printing press comprising, in combination:

at least one printing unit or dedicated coating unit having side frame members forming a tower;

at least one cylinder mounted for rotation on the tower for printing ink or coating material onto sheets passing through the printing unit or dedicated coating unit, the cylinder mounting either a plate or a blanket;

inking/coating apparatus including a doctor blade assembly having a reservoir for holding ink or coating liquid, a rotatable applicator roller and means for applying ink or coating liquid from the reservoir onto a peripheral surface portion of the applicator roller; and

support apparatus mounted on the tower for pivotal movement, the inking/coating apparatus pivotally mounted to the support apparatus, the support apparatus movable relative the printing unit tower between an operative position in which the applicator roller is directly engaged with a plate or blanket on the cylinder and a retracted position in which the inking/coating apparatus is support at an elevated position above the cylinder.

13. A rotary offset printing press comprising, in combination:

a plate cylinder having a printing plate mounted thereon;

a blanket cylinder having an ink receptive blanket disposed in ink transfer engagement with the plate cylinder for transferring ink from the image surface areas of the printing plate to the receptive blanket;

an impression cylinder disposed adjacent the blanket cylinder thereby defining a nip between the impression cylinder and the blanket whereby the printing ink is transferred from the blanket to a substrate as the substrate is transferred through the nip;

inking/coating apparatus for applying ink or coating material to the plate or to the blanket;

support apparatus pivotally mounted on the printing press, said support apparatus and said inking/coating apparatus being pivotally connected, said support apparatus being pivotal between an operative position in which the inking/coating apparatus is directly engaged with the

plate or the blanket, and a retracted position in which the inking/coating apparatus is supported at an elevated position above the press; and

a dryer mounted on the press for discharging heated air on the freshly printed substrate.

14. A rotary offset printing press as defined in claim 13, wherein:

the dryer is mounted adjacent the impression cylinder for discharging heated air onto a freshly printed substrate while the substrate is in contact with the impression cylinder.

15. A rotary offset printing press as defined in claim 13, comprising:

an extractor coupled to the dryer for extracting hot air, moisture and volatiles from an exposure zone between the dryer and the freshly printed substrate.

16. A rotary offset printing press as defined in claim 13, comprising:

a transfer cylinder disposed in an interstation position on the press and coupled in sheet transfer relation with the impression cylinder; and,

an interstation dryer disposed adjacent the transfer cylinder for discharging heated air onto a freshly printed or coated substrate after it has been transferred from the impression cylinder and while it is in contact with the intermediate transfer cylinder.

17. In a printing press of the type having side frame members forming a tower on which a blanket cylinder is supported for rotation, the improvement comprising:

inking/coating apparatus for applying ink or coating material to a blanket mounted on the blanket cylinder when the inking/coating apparatus is in an operative position; and

a carriage assembly pivotally mounted to the tower and to the inking/coating apparatus, said carriage assembly movable between an operative position and a retracted position, said inking/coating apparatus pivoting relative the carriage assembly as the carriage assembly is

moved between the operative position and retracted position to maintain a relatively constant orientation to the horizontal, the inking/coating apparatus in direct contact with the blanket cylinder in the operative position and elevated with respect to the blanket cylinder in the retracted position.

18. In a printing press of the type having side frame members forming a tower on which a blanket cylinder is supported for rotation, the improvement comprising:

inking/coating apparatus for applying ink or coating material to a blanket mounted on the blanket cylinder when the inking/coating apparatus is in an operative position;

a carriage assembly pivotally mounted to the tower and to the inking/coating apparatus, said carriage assembly movable between an operative position and a retracted position, said inking/coating apparatus pivoting relative the carriage assembly as the carriage assembly is moved between the operative position and retracted position to maintain a relatively constant orientation to the horizontal;

tower including a plate cylinder and a plate mounted on the plate cylinder, the inking/coating apparatus including:

first cradle means for supporting an applicator roller for engagement against the plate when the inking/coating apparatus is in the operative position; and

second cradle means for supporting an applicator roller for engagement against the blanket when the inking/coating apparatus is in the operative position.

19. In a printing press of the type having side frame members forming a tower on which a blanket cylinder is supported for rotation, the improvement comprising:

inking/coating apparatus for applying ink or coating material to a blanket mounted on the blanket cylinder when the inking/coating apparatus is in an operative position;

a carriage assembly pivotally mounted to the tower and to the inking/coating apparatus, said carriage assembly movable between an operative position and an retracted position, said inking/coating apparatus pivoting relative the carriage.

20. The invention as set forth in claim 17, further comprising:

a power actuator pivotally coupled to the support arm, the power actuator having a power transfer arm which is extendable and retractable; and,

apparatus coupled to the power transfer arm for converting extension or retraction movement of the power transfer arm into pivotal movement of the inking/coating apparatus relative to the common pivot shaft.

21. In a printing press of the type having side frame members forming a tower on which a blanket cylinder is supported for rotation, the improvement comprising:

inking/coating apparatus for applying ink or coating material to a blanket mounted on the blanket cylinder when the inking/coating apparatus is in an operative position;

a carriage assembly pivotally mounted to the tower and to the inking/coating apparatus, said carriage assembly movable between an operative position and a retracted position, said inking/coating apparatus pivoting relative the carriage assembly as the carriage assembly is moved between the operative position and retracted position to maintain a relatively constant orientation to the horizontal;

a power actuator pivotally coupled to the support arm, the power actuator having a power transfer arm which is extendable and retractable;

apparatus coupled to the power transfer arm for converting extension or retraction movement of the power transfer arm into pivotal movement of the inking/coating apparatus relative to the common pivot shaft;

the movement converting apparatus comprising:

a bell crank plate having a first end portion coupled to the power transfer arm and having a second end portion for engaging a stop member;

a stop member secured to the inking/coating apparatus; and,

a cleavis plate secured to the support arm and pivotally coupled to the bell crank plate.

22. The invention as set forth in claim 1, wherein the inking/coating apparatus comprises:

an applicator roller having a resilient transfer surface.

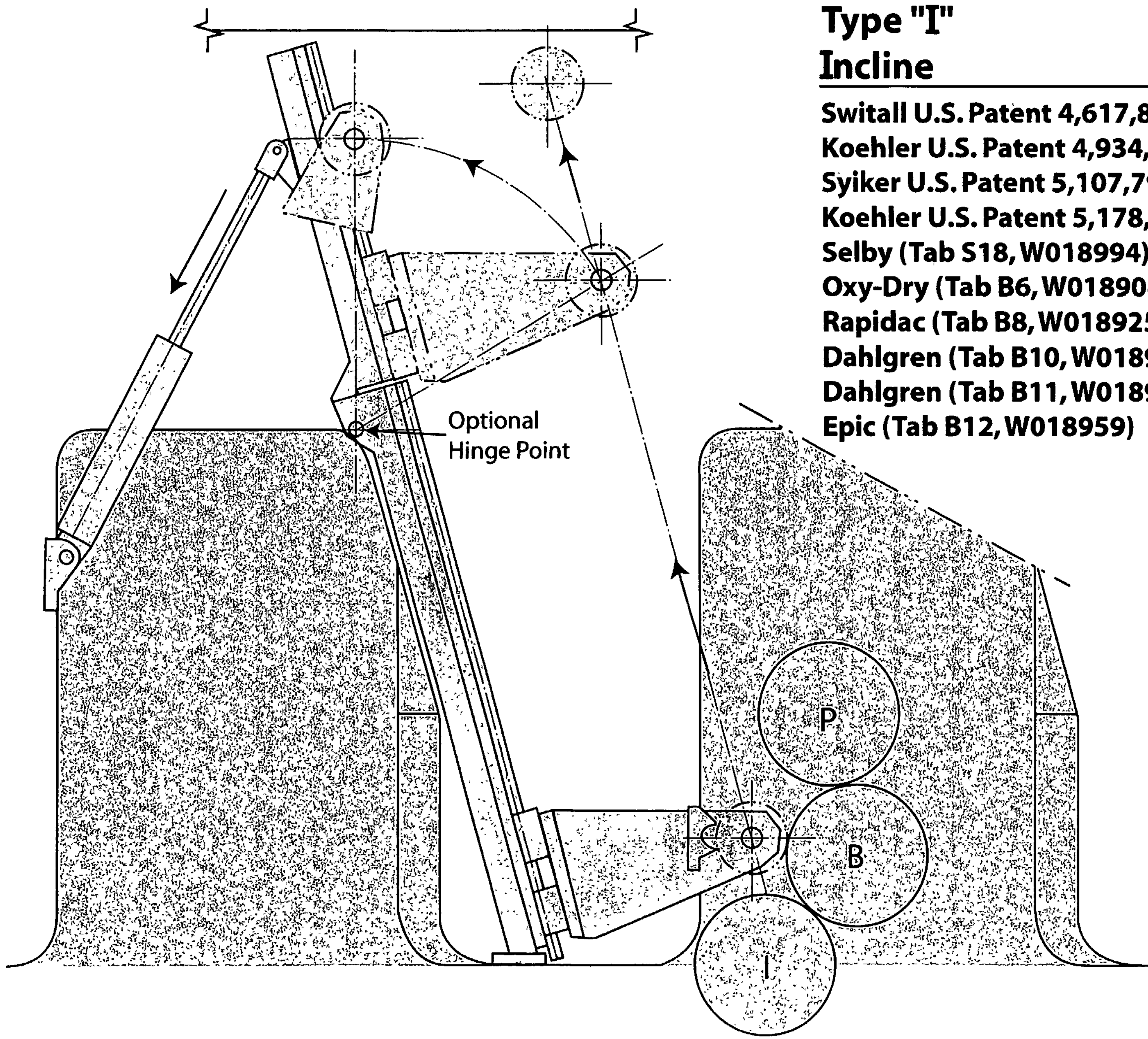
23. The invention as set forth in claim 1, wherein the applicator roller is mounted for engagement to a plate in the plate cylinder position, the applicator roller comprising an anilox roller having a resilient transfer surface.

EXHIBIT E

Known Retraction System Adapted for Interstation Use

Type "I"
Incline

Switall U.S. Patent 4,617,865 (Tab P38, W019343)
Koehler U.S. Patent 4,934,305 (Tab P58, W019519)
Syiker U.S. Patent 5,107,790 (Tab P64, W019592)
Koehler U.S. Patent 5,178,678 (Tab P67, W019630)
Selby (Tab S18, W018994)
Oxy-Dry (Tab B6, W018904)
Rapidac (Tab B8, W018925)
Dahlgren (Tab B10, W018940)
Dahlgren (Tab B11, W018945)
Epic (Tab B12, W018959)

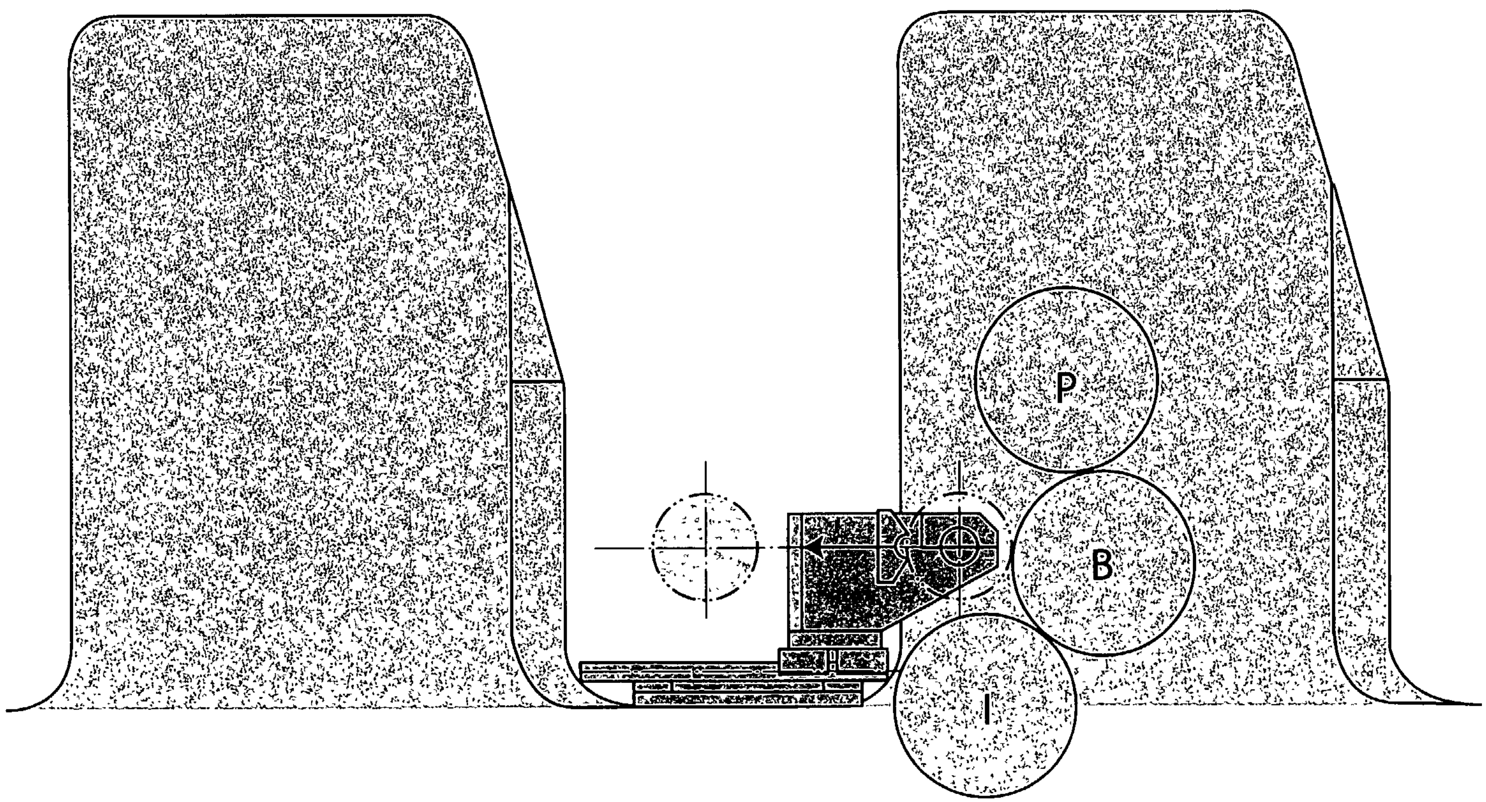


Schematic
(1/10 Scale)

Known Retraction System Adapted for Interstation Use

Type "H"
Horizontal

Rosenstadt U.S. Patent 3,604,350 (Tab P9, W019089 and W019092)
Di Rico U.S. Patent 4,685,414 (Tab P41, W019373 and W019374)
Dahlgren (Tab B4, W018890 and W018892)
Dahlgren (Tab B5, W018898 and W018900)
Dahlgren (Tab B7, W018919)
Dahlgren (Tab B9, W018935)

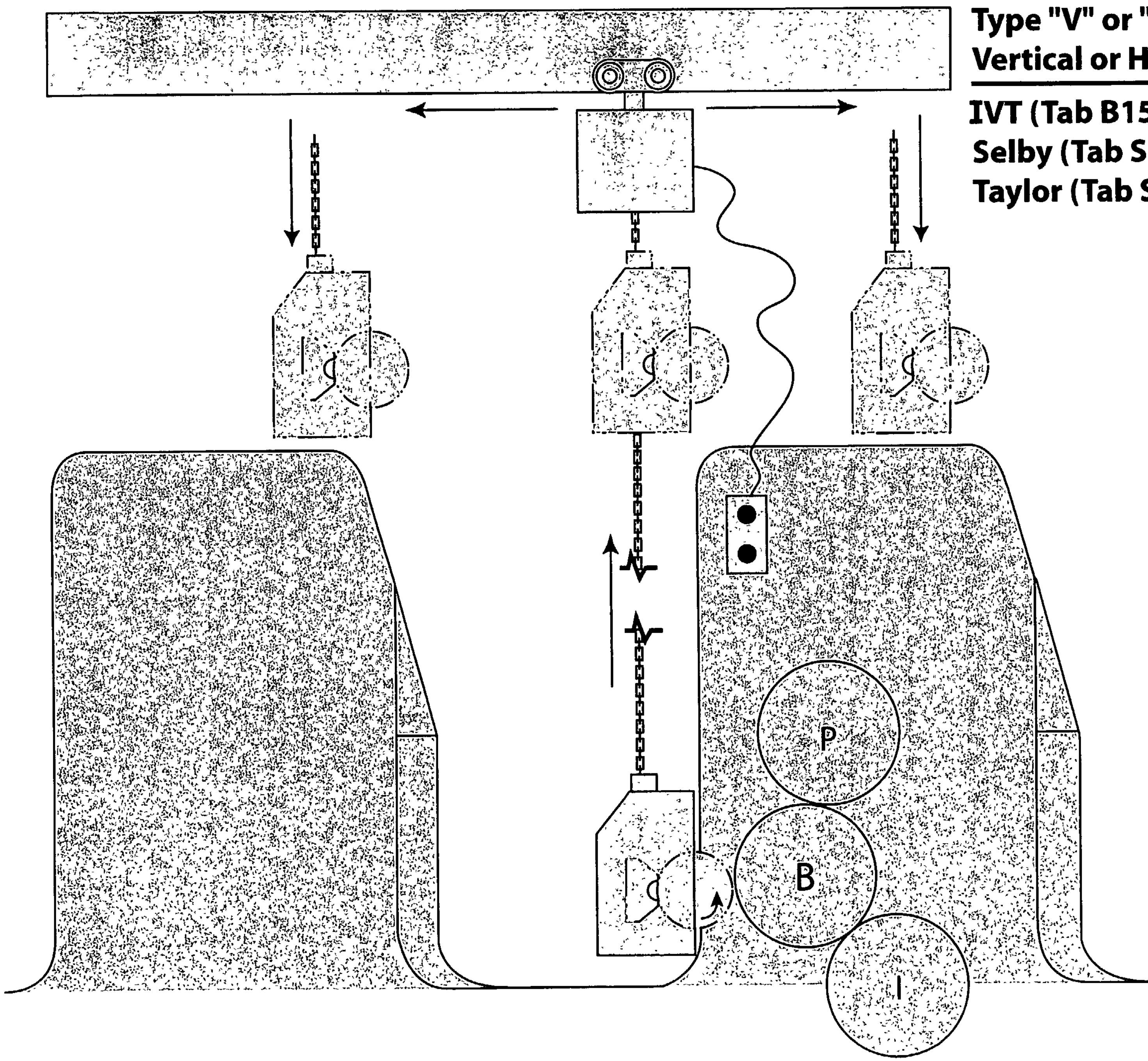


Schematic
(1/10 Scale)

Known Retraction System Adapted for Interstation Use

Type "V" or "H/V" or "V/H"
Vertical or Horizontal and Vertical

IVT (Tab B15, W018977)
Selby (Tab S18, W018991)
Taylor (Tab S18, W019000)

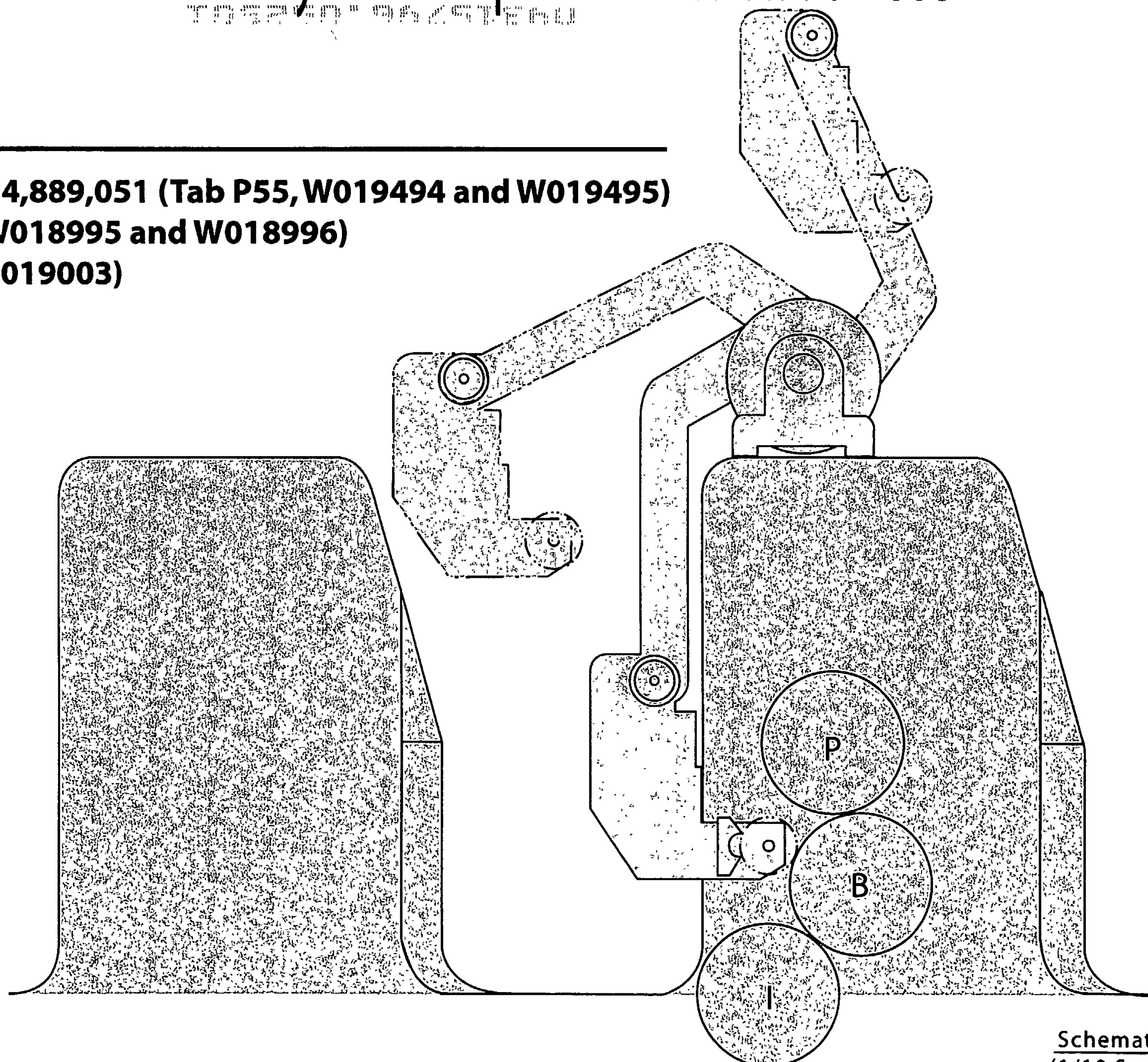


Schematic
(1/10 Scale)

Known Retraction System Adapted for Interstation Use

Type "F"
Ferris Wheel

Sarda U.S. Patent 4,889,051 (Tab P55, W019494 and W019495)
Taylor (Tab S18, W018995 and W018996)
Selby (Tab S18, W019003)

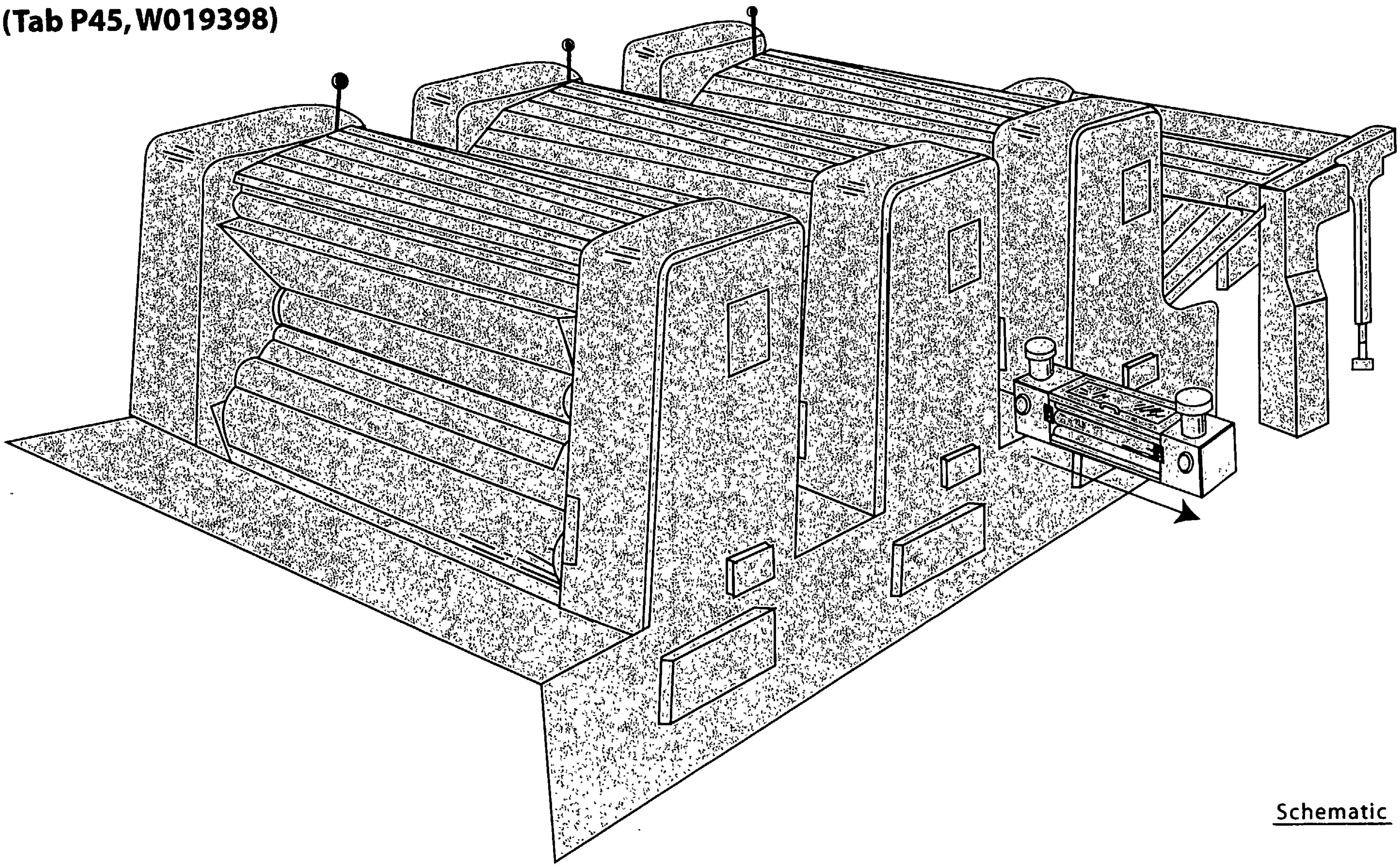


Schematic
(1/10 Scale)

Known Retraction System Adapted for Interstation Use

Type "T"
Transverse

Frazzitta U.S. Patent 4,779,557
(Tab P45, W019398)

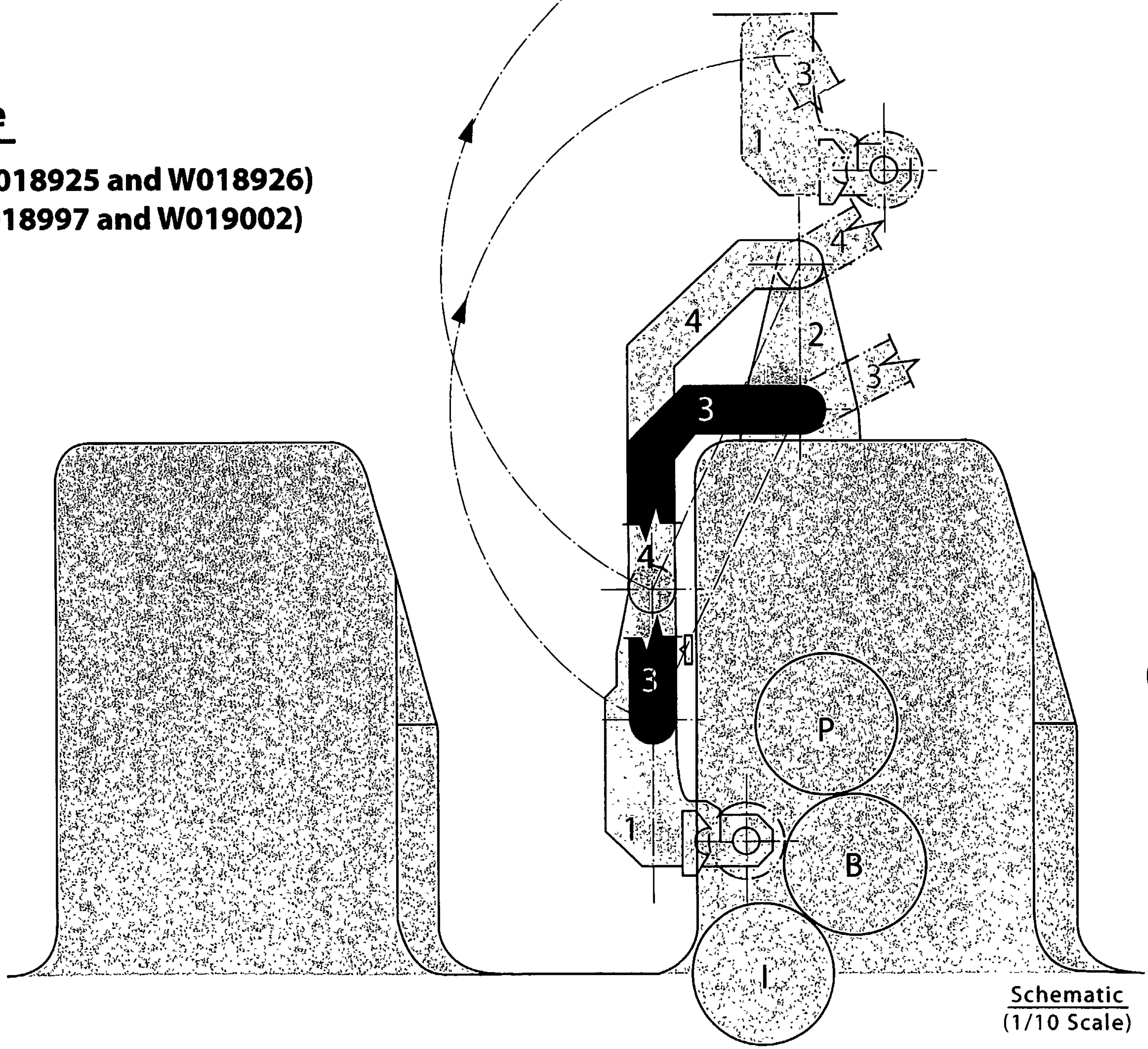


Schematic

Known Retraction System Adapted for Interstation Use

Type "FB"
Four Bar Linkage

Rapidac (Tab B8, W018925 and W018926)
Taylor (Tab S18, W018997 and W019002)

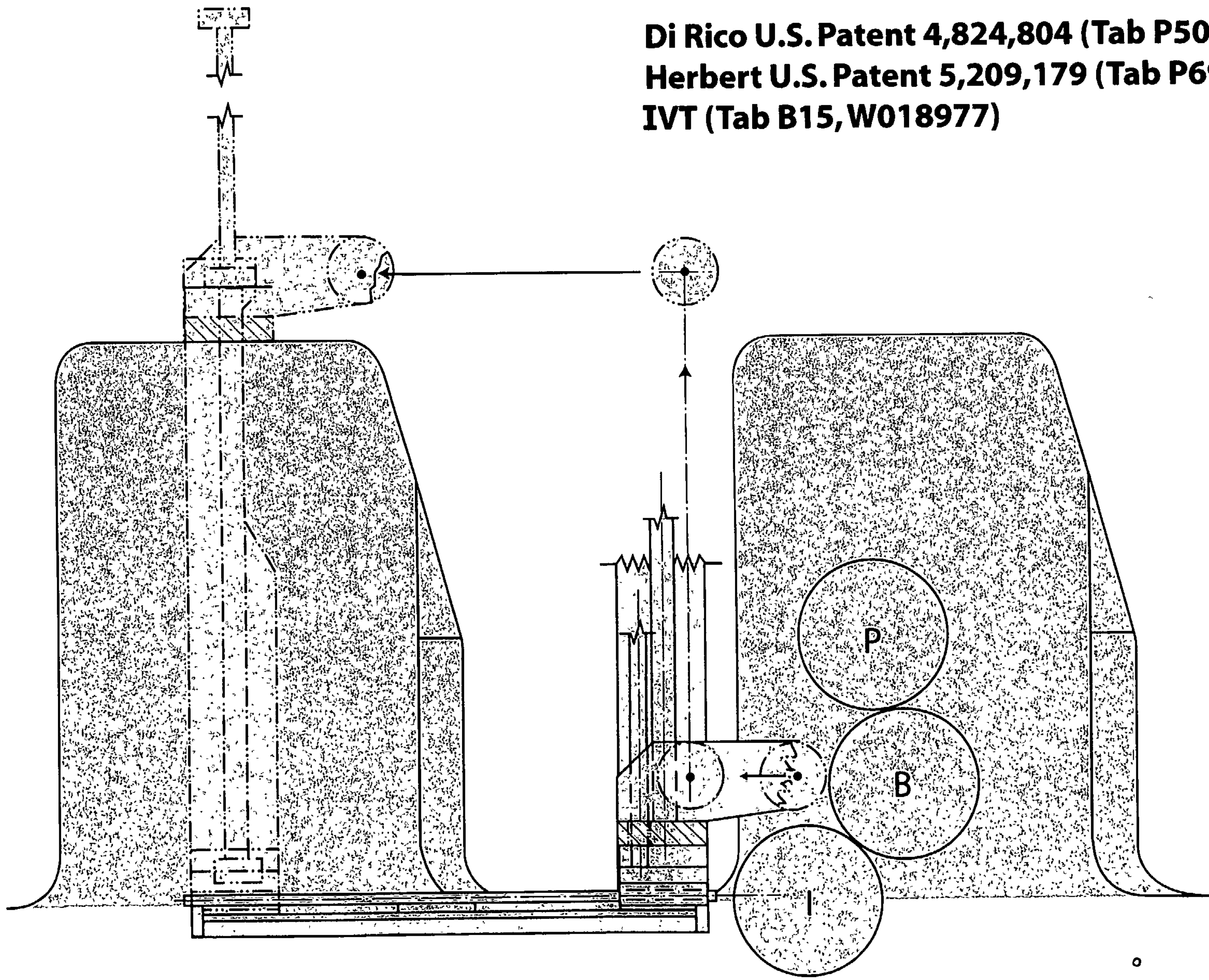


Schematic
(1/10 Scale)

Known Retraction System Adapted for Interstation Use

Type "X/Y" Combination
"H/V" or "H/I" or "V/H" or "I/V"

Di Rico U.S. Patent 4,824,804 (Tab P50, Fig. 2, W019446)
Herbert U.S. Patent 5,209,179 (Tab P69, W019658)
IVT (Tab B15, W018977)

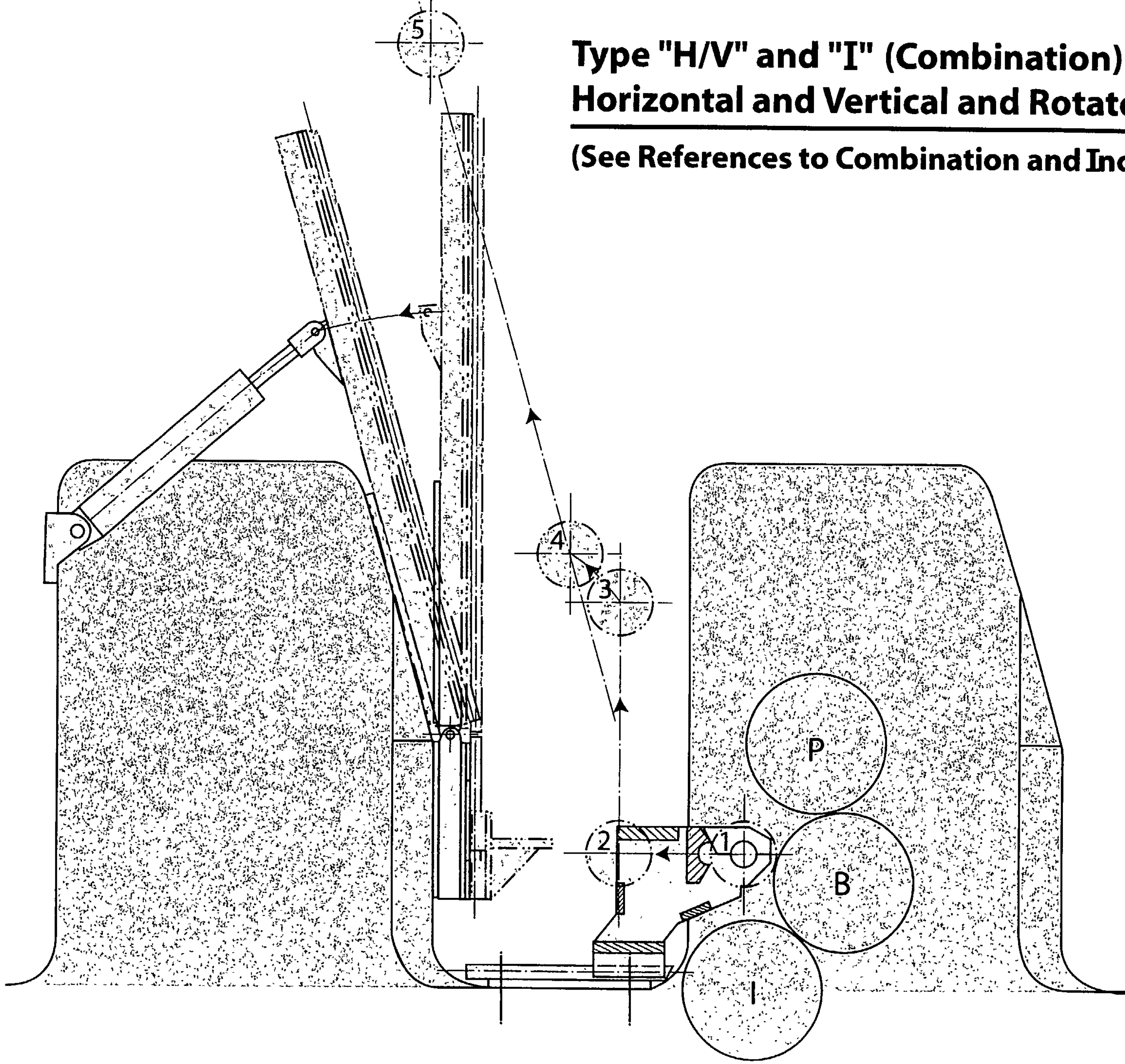


Schematic
(1/10 Scale)

Known Retraction System Adapted for Interstation Use

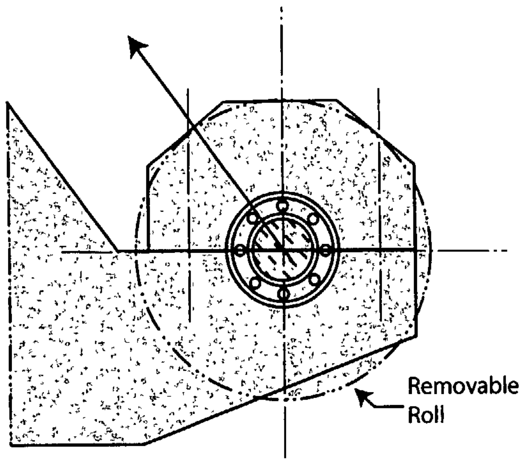
Type "H/V" and "I" (Combination)
Horizontal and Vertical and Rotate to Incline

(See References to Combination and Incline)

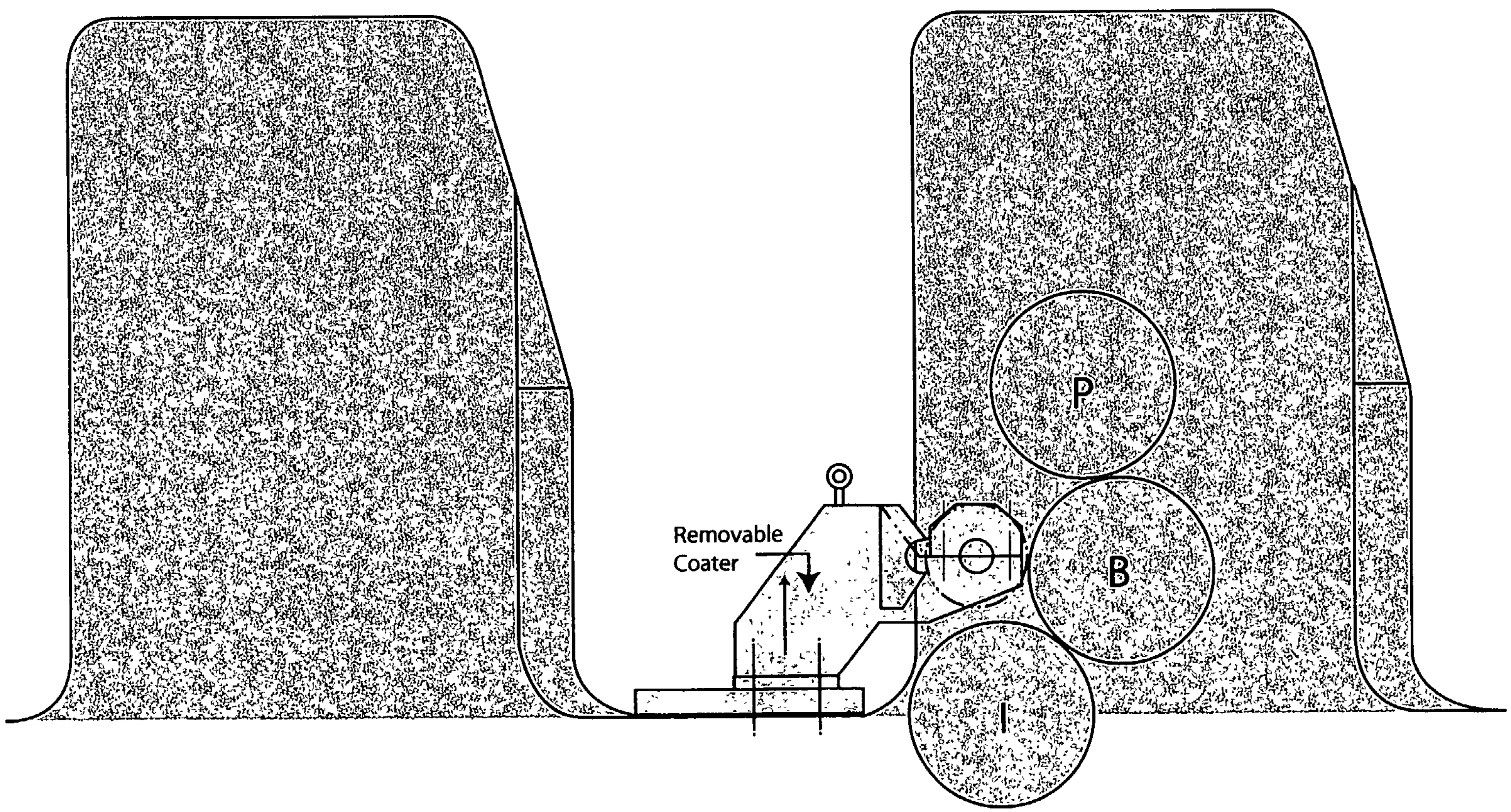


Schematic
(1/10 Scale)

Known Manually Removable Coater or Roll



Terry U.S. Patent 2,333,962 (Tab P3, W019031)
Satterwhite U.S. Patent 4,308,796 (Tab P20, W019185)
Tokuno U.S. Patent 4,586,434 (Tab P36, W019329)
Rapidac (Tab B8, W018933)



Schematic
(1/10 Scale)

EXHIBIT F

COST AND QUALITY:

A DAMPENER DILEMMA?

By James E. Taylor

The late Harold Dahlgren, who 30 years ago pioneered today's continuous-duty dampening technology, once said, "You can count on one hand those who really understand the principles and intricacies of lithography and the dampening process."

The natural question is, who did he mean?

Having spent many years under the instruction of Mr. Dahlgren, I learned a good deal about continuous-duty dampening, and what follows is a discussion on the cost factors and qualitative advantages of this technology as it applies to today's sheet and web-offset press printers.

Basically, a "continuous-duty" dampener dampens the plate cylinder of an offset lithographic press through a system of rolls ... whether the press is ...

This differs from ... "conventional" dampeners ... brush and ... when the press runs ...

... dampeners permit ... With conventional ... related ...

... who demands premium ... control, there is no substitute ... continuous-duty dampener.

... many printers with conventional ... achieve quality just as high, ... they can compete without ... continuous-duty system. ... continuous-duty dampeners ... more ... used press is ...

... plan to keep the press ... the investment will not only ... savings in reduced printed ... but you will also benefit ... significant positive cash flow over an ... And eventually when you do sell your used press, it will com-

... press ...

... values a continuous-duty dampener can bring to a commercial offset sheet or web lithographic press operation:

- *a) Increased quality of the printed product.*
- *b) Consistency due to the continuous process*
- *c) Efficiency in ink/water balance*
- *d) Ease of printing combination layouts*
- *e) Flexibility to use a broader range of stocks*
- *f) Reduced pressman fatigue*
- *g) Time savings*
- *h) Reduced waste*
- *i) Economies in drying*
- *j) Less expense in offset spray powders*
- *k) Faster back-up; trimming, folding, etc.*
- *l) Reduced maintenance on equipment*
- *m) Increased productivity*
- *n) Savings in chemical & ink usage*

... better understand ... continuous-duty dampening can deliver ... results ... consider ... areas of ...

Increased Quality of the Printed Product

Because a continuous-duty dampener provides precise water control, a thinner film of ink can be used. As a result, your ... deeper. If you ... using a conventional dampener, you'd achieve these qualities ... ideal printing conditions. A continuous-duty dampener enables the highest quality printing.

Consistency Due to the Continuous Process

Since a continuous-duty dampener ... the limits of the ...

ink/water balance. Color remains as constant and uniform as the ink feed, with fewer adjustments and delays. You save time and fatigue because, unlike a conventional dampener, there's no need for constant attention and re-adjustment throughout the run.

Efficiency in Ink/Water Balance

Continuous-duty dampening meters water in the precise minimum quantity demanded by the ink. With a conventional dampener, if there's too much water, the ink becomes contaminated and loses its body and tinctorial strength. Weak ink means more ink, which plugs halftones and weakens solids. Precise ink/water balance permits brilliant solids, thinner films and the clean, sharp reverses and shadows you get from using a dry, full-bodied ink.

Ease of Printing Combination layouts

Because you don't have to compensate with the water stops of a continuous-duty dampener, printing difficult layouts, short sheets and large non-printing areas is simplified. No water invades the ink, so stripping and emulsification is eliminated. And because you don't plug delicate half tones and reverses, you can print the finest 90% shadow dot clean and open, while holding strong, adjacent solids up to color. In short, a continuous-duty dampener lets you print the plate, regardless of the layout without all of the problems you normally have to put up with.

Flexibility to Use a Broader Range of Stocks

The combined qualities of a continuous-duty dampener allow you to print efficiency and profitably on good enamels, foil, gummed stock (even on the gummed side) as well as plastics, metal and all non-absorbing specialty papers, none of which can tolerate any surplus water. Unlike conventional dampeners, a continuous-duty dampener does not limit your profit potential: now you can print the tough jobs you used to shy away from.

Reduced Pressman Fatigue

A continuous-duty dampener achieves water balance in 1/2 the time it takes for a conventional dampener to do the same. When you change a setting, you get a response on the next revolution, not 50 or 100 sheets later. You can start or resume printing without color variation due to water, as soon as the inker is recharged. As a result, productivity is increased and excess waste eliminated.

Minutes a day, hours a week, a continuous-duty dampener will add to your productive time, allowing you to print as quickly as the form rollers are inked.

Efficiencies in the Wash Up Phase

Wash up and shutdown times are reduced with a continuous-duty dampener, because the form roller inks and washes automatically with every revolution of the press. The transfer and metering rolls need no special attention when changing jobs or colors, so downtime is reduced.

Reduced Waste During Proofing

Press proofs and progressives are produced quickly because only a handful of sheets are needed to get 10 or 12 good proofs. Compare that with the hundreds normally required by a conventional system, and you'll see why a press equipped with a continuous-duty dampener allows you to get proofing colors on and off the press before conventionally equipped systems even get up to color.

What's more, going from color to color is easier because no time is lost cleaning or replacing dampener sleeves. Make subtle changes for "darker" or "lighter" proofs on as few as one or two sheets, then return to the original shade on the next revolution. Simulation runs are more practical, proofing time and cost is reduced and, dot-for-dot reproduction can be achieved from the proofing plate.

Economies in Drying

A continuous-duty dampener prints with less moisture in the ink and sheet, providing a thinner, drier, tackier ink film. The advantages include better trapping and smoother lays, with less curl in the paper and less offset spray. Printed sheets usually set and dry in half the time it takes for a conventionally printed piece. And because sheets dry faster and more uniformly, back up, trimming and folding can be accomplished faster.

Overall Benefits

In all, continuous-duty dampening provides for less sheet waste, reduced ink and chemical usage, less downtime for startup, restarts or maintenance and faster wash up than printing with a conventional dampener. And while an expert pressman, with a good press, ideal conditions and continual attention can approach the quality associated with continuous-duty dampeners, the cost in terms of maintenance, press downtime and waste makes printing with conventional dampeners outmoded, impractical and even prohibitive for a profitable operation.

Cost Justification

As an example of cost-justification for the purchase of a continuous-duty dampener, consider a 4/C 40", hi-speed commercial sheet-fed offset press. The total price of a continuous-duty dampener for this system could run approximately $90,000.00.

On a 60-month note, you would pay $1,500 principal and $468.75 approximate interest per month for a total monthly payment of $1,968.75.

Using a conservative monthly expense reduction, you could figure sheet waste with conventional dampeners at 200 sheets x 4 setups (startup jobs or restarts due to color loss or other dampener-related problems) x 25 shifts for a total of 20,000 sheets per month at $80.00 per 1,000 ... per month in ...

COST JUSTIFICATION OF CONTINUOUS DUTY DAMPENERS

Savings compared to conventional dampeners

Normal paper waste per month

200 sheets of paper per set-up
x 4 set-ups per shift
800 sheets per shift
x25 sheets per month
20,000 sheets per month

20,000 sheets at $80 per 1,000 sheets = $1,600 mo.

Normal equipment downtime and labor cost per mo.

1 hour downtime per set-up
x 4 set-ups per shift
4 hours per shift
x25 shifts per month
100 hours per month

100 hours of downtime at $200 per hour	$20,000 mo
Total cost [paper and downtime]	$21,600 mo
Savings of 60% of cost of paper and downtime	x.60
by using continuous duty dampeners	$12,960 mo

Purchase price of continuous duty dampeners: approximately $90,000

Cost per month on 5 year note

$1,500 principal per month	
468 per month	
$1,968 total payment	$ -1,968 mo
Potential additional monthly profits during 60 month note	$10,991 mo

$90,000 ÷ $10,991 = 8.19

This would represent a payback of approximately 8 months on total capital invested. It does not include depreciated or retained value.

Downtime on conventional dampeners could be estimated at 60 minutes x 4 setups x 25 shifts for 6,000 minutes, or 100 hours wasted each month. At an all-inclusive hourly cost of $200.00, the total monthly loss from downtime with conventional dampeners would be $20,000.00. Adding the paper cost of $1,600 gives us a $21,600 per month total loss for downtime and materials.

Using these figures, a continuous-duty dampener will reduce your monthly expense of $21,600.00 by 60%, or $12,960.00. After subtracting a monthly payment of $1,968.75, a continuous-duty dampening system provides a potential positive cash flow of $10,991.25 each month. Looking at this from a payback point-of-view, you would easily recoup your investment in as few as eight months.

Obviously, you don't have to be one of the few "who really understands the principals and intricacies of lithography and the dampening process" to appreciate the economies of continuous-duty dampening. The money lost on waste and downtime can be yours. In fact, it may be the difference in whether you're profitable or not. Before you lose more money on your conventionally equipped press, consider what you stand to gain by adding a continuous-duty dampening system.

What to Look For In a Continuous-Duty Dampener

Since the original Dahlgren dampener patents expired a few years ago, many press manufacturers have designed continuous-duty dampeners for their presses. Therefore, there are several continuous-duty dampeners available for both existing and new presses. The number of rolls in the system can vary from three to as many as seven. The composition and position of the rolls can also vary widely. One or more rolls may have a resilient surface, while others may have a hydrophilic (water receptive, ink rejecting) surface. Some designs have a frictionally rotated dampening form roll driven from a press-driven, adjacent ink or dampener roll, while others may be more positively geared or motor driven near, greater or less than plate-surface speed. For example, Dahlgren introduced a four (4) roll coater-dampener in the late 70s and early 80s, wherein an [illegible] form roll, bridged to the inker via an idler roll, was capable of running greater than, equal to or less than press plate surface speed in both coating and dampening modes of operation. (The bridge roll was removed when coating.) For example, the efficiency, simplicity of operation, water control and maintenance required for each design is different. However, most continuous-duty dampeners share certain common features, particularly these 10.

1) A [illegible] covered [illegible] [illegible] dampening fluid [illegible] form roll.

2) An independently driven, variable speed transfer roll. (some have hard chrome hydrophilic surfaces, while others are resilient covered rolls).

3) A metering roll normally geared to the transfer roll, either 1:1 or at a fixed differential. (Again, some have hard chrome hydrophilic surfaces, while others have resilient covers.)

4) A dampening fluid supply at the entrance to the nip, between the transfer and metering rolls.

5) Pressure contact at all adjacent roll surfaces (normally surfaces alternate between hard and resilient).

6) A continuously recirculated dampening fluid supply system wherein the fluid can be filtered and temperature-controlled as desired.

7) Lateral control of dampening fluid across the length of the rolls (skewed or crowned metering roll).

8) Transfer and meter rolls normally being longer and extending past the ends of the adjacent dampener roll.

9) Alcohol or alcohol substitute [illegible] ment in the fountain solution. The alcohol can range from 5-25% of the total amount of solution.

10) Positive, adjustable roll settings (No springs).

Following are the Dahlgren Three (3) and four (4) Roll Differential-Driven Dampener schematics, with accompanying descriptions. Note: All of the above ten (10) features are incorporated on these dampeners.

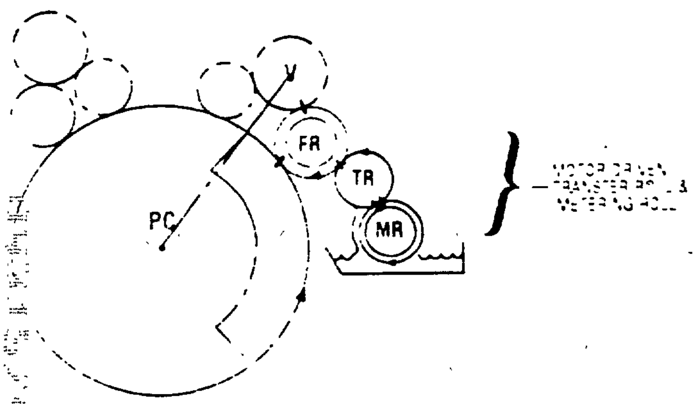
Schematic and Description: Dahlgren Three (3) Roll

This Dahlgren system of dampening is designed for sheet or web presses to apply the minimum effective amount of water in the printing process through a three-roll system. By minimizing the amount of water on the printed surface, Dahlgren dampeners reduce drying time, improve clarity and preserve an effective ink/water balance.

Specific benefits of the Three (3) Roll [illegible]

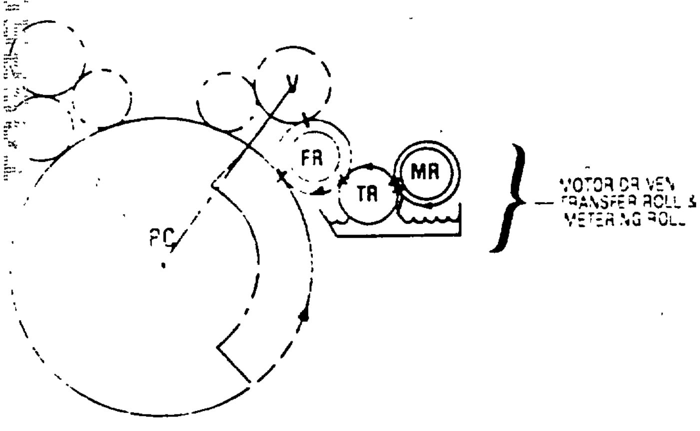
-Precise, uniform water [illegible]

-Stronger colors/uniform color
-Cleaner reverses
-Sharper halftones
-Faster start-up and wash-up
-Immediate response
-Less spray Powder (sheet fed presses)
-Faster drying
-Low maintenance
-Operational Ease
-Less ink and water use
-"Up to Color" quickly
-"Finger-tip" control of ink/water balance



DAHLGREN THREE ROLL DRIVE

[illegible] shown below



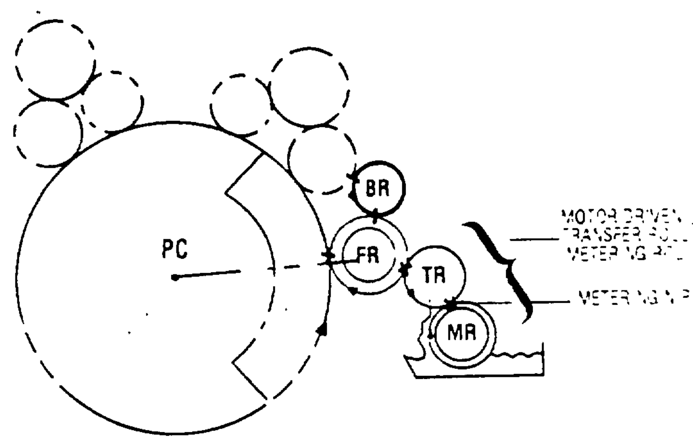
DAHLGREN THREE ROLL DRIVE

Schematic description:

The Dahlgren system of dampening is accomplished with two basic designs. In both designs fountain solution is lifted from the water pan and is conveyed to a point between the Metering Roll and the Transfer Roll. At this point [illegible] press [illegible] meters the fountain solution into a thin uniform film. As the rotating surface [illegible] the film splits — for the first time — into two thinner films. One film remains on the Metering Roll surface and returns to the water pan. The other film is conveyed on the surface of the Transfer Roll to the contact point between the Transfer Roll and the Form Roll where the film splits for the second time.—One film remains on the Transfer Roll and returns to the water pan. The other film bonds with the ink film on the Form Roll and is conveyed to the contact point between the Form Roll and the Plate Cylinder. It is here that both dampening fluid and a full charge of ink are imparted to the plate for printing. After the metering roll has been accurately set, speed differential between the hydrophilic chrome Transfer Roll and the Form Roll is the only control needed for any plate design or sheet size.

Schematic and Description: Dahlgren Four (4) Roll with Differential Drive

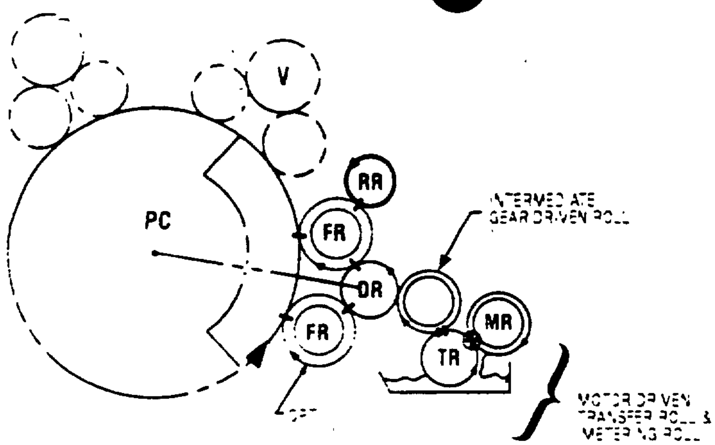
The Dahlgren Four-Roll system primarily for sheet-fed press applications, provides differential drive control at three strategic nips: between the metering roll and transfer roll, the transfer roll and form roll, and between the form roll and the plate. This design incorporates a self-oscillating idler roll that connects the dampening form roll to the first ink form roll on the press, for a more even application of ink. While this is the basic Dahlgren four-roll design, variations can be achieved for a custom fit on any press



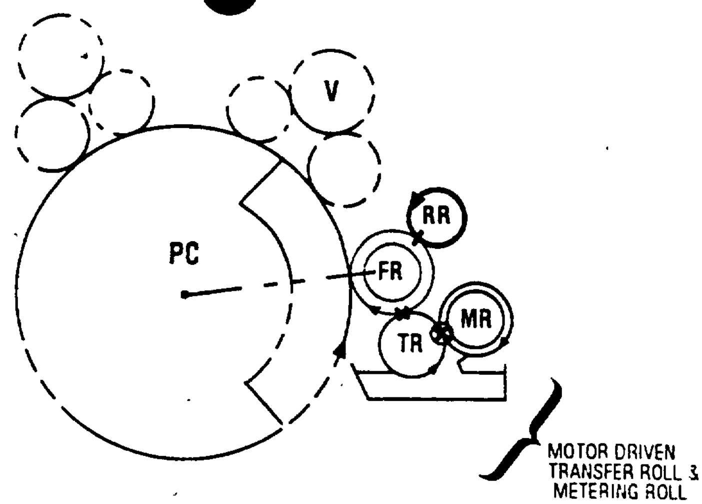
DAHLGREN FOUR ROLL DIFFERENTIAL DRIVE

Additional benefits of the four (4) roll differential drive dampener are:

-Print heavy and smooth solids



O.M.C.S.A.
(POLI - FLO)



ROLAND - MIEHLE
(MIEHLE - MATIC*)

(NOT TO SCALE)

LEGEND:

Phantom lines (press)

Solid lines (dampener)

V = Ink vibrator (press oscillator)

PC = Press Plate Cylinder

Drive from press to dampener (approx. = plate speed)

Pan reservoir (for water pick up)

Resilient covered roll (ink & dampening fluid carrying)

Resilient covered roll (dampening fluid carrying)

Hard (rubber, plastic, etc. ink carrying) Oleophylic

Hard-chrome plated (dampening fluid receptive, ink rejecting) Hydrophylic

Friction nip

Slip nip

Metering nip

FR = Dampening Form Roll

RR = Rider Roll; BR = Bridge Roll (each may oscillate, RR may be optional)

DR = Distribution Roll (Osc.)

TR = Transfer Roll

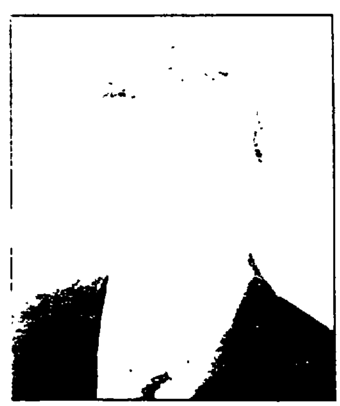
MR = Metering Roll

** THIS DAMPNER WAS LICENSED TO THE MIEHLE CO. BY DAHLGREN MFG. CO. IN THE 60'S & 70'S.*

As one can readily see, there are many varied configurations of continuous-duty dampeners, and while all appear to achieve the intended purpose, some work better than others. I guess there's more than one way to skin a cat.

However, many still wonder to whom Mr. Dahlgren was referring when he boldly said, that he could "count on one hand those who really understand the principles and intricacies of lithography and the dampening process." But, then again, *he* was a bold man!

James E. Taylor, is presently O.E.M. & Technical Sales Manager for DAHLGREN USA, Inc.. Mr.. Taylor previously served as Vice-President, Research & Development of Dahlgren International, Inc.. He has been with the corporation for 27 years



DAHLGREN
P.O. Box 115140, Carrollton, TX 75011
(214) 245-0035

Portions of this article were previously published in the Nov/Dec 1990 issue of *Graphic Arts Product News*

-Uses less alcohol

-Less ghosting

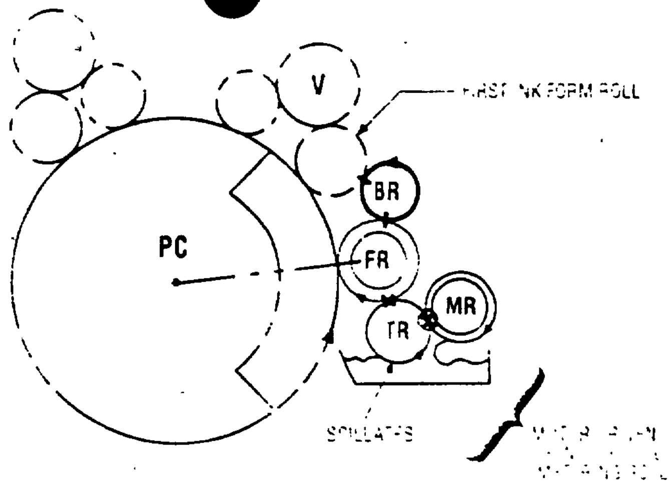
Schematic description:

The Dahlgren Four-Roll system of dampening is accomplished primarily with one ... design. In this design fountain solution is picked up by the Metering Roll and is conveyed to a point between the Metering Roll and Transfer Roll. At this point pressure meters the fountain solution into a thin uniform finite quantity. As the rotating surfaces part the quantity shears and divides—for the first time—into two thin films. One film remains on the Metering Roll surface and returns to the pan. The other film is placed on the surface of the Transfer Roll ...

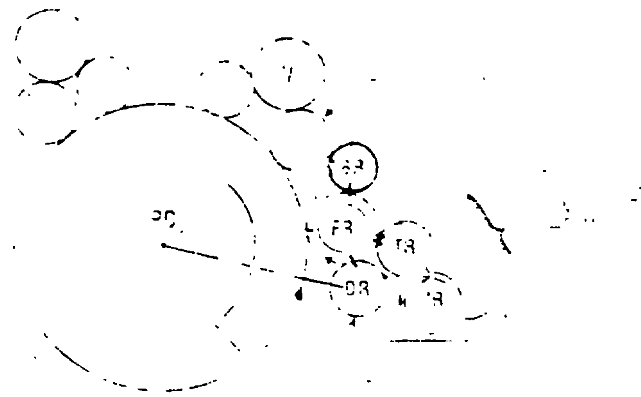
... between the Transfer ... Roll ... between the Form ... between the Transfer ... Thus a "differential" ... controlled supply at ...

Other Continuous Duty Dampeners

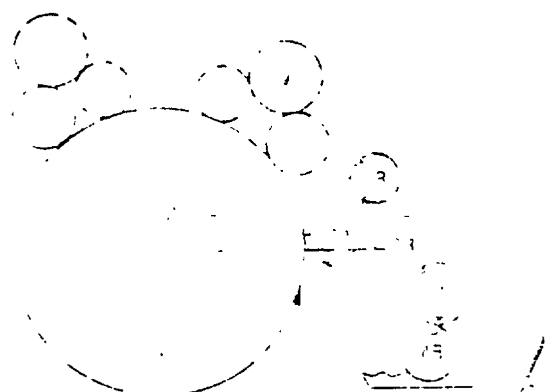
S... are schematics of some of the ... dampener configurations ... as well as new press ... press manufacturers ... continuous duty dampeners as standard, optional or sometimes retrofit ... equipment.



MAN - MILLER
(ALCOTRON)



HEIDELBERG
(ALCOLOR III)



MAN - ROLAND
(ROLAND-MATIC)

EXHIBIT G

Exhibit G

Drawing No.	***Date of Drawing***
PRI 01147	5/16/91
PRI 001149 - PRI 01150	5/16/91
PRI 01145 - PRI 01146	9/21/91
PRI 01148	11/21/91
PRI 01125 - PRI 01126	6/5/92
PRI 01151 - PRI 01152	6/5/92
PRI 01156 - PRI 01157	8/3/93
PRI 01153	8/20/93
PRI 01154	1/12/94
PRI 01155	1/18/94
PRI 01122	10/26/94
PRI 01123	11/8/94
PRI 01138	11/8/94
PRI 01124	12/1/94
PRI 01139	12/5/94 & 12/7/94
PRI 00004 - PRI 00005	12/5/94
PRI 00008 - PRI 00011	12/5/94
PRI 01140	12/27/94
PRI 01141	12/28/94
PRI 00006	12/30/94
PRI 00685	12/30/94
PRI 01142	12/30/94
PRI 01137	12/30/94
PRI 00007	12/30/94
PRI 00013	12/30/94

Drawing No.	*Date of Drawing*
PRI 00012	12/30/94
PRI 000675	1/27/95
PRI 00670	2/14/95
PRI 01143	2/15/95
PRI 01144	2/15/95
PRI 01158 - PRI 01159	2/18/95
PRI 01166 - PRI 01167	2/23/95
PRI 01160 - PRI 01161	2/25/95
PRI 01172 - PRI 011773	2/25/95
PRI 01163 - PRI 01165	3/6/95
PRI 01168	3/9/95
PRI 01169	3/9/95
PRI 01162	3/10/95
PRI 01174 - PRI 01175	3/10/95
PRI 01170 - PRI 01171	3/14/95
PRI 01176	4/19/95
PRI 01177 - PRI 01178	4/25/95
PRI 01350	8/4/95
PRI 01352	8/18/95
PRI 01351	8/22/95
PRI 01353	9/14/95
PRI 01359	10/4/95
PRI 01354	10/19/95
PRI 01355 - PRI 01356	10/26/95
PRI 01357 - PRI 01358	11/1/95
PRI 01360	11/21/95
PRI 01361	11/26/95

Drawing No.	***Date of Drawing***
PRI 01362	11/30/95
PRI 00059	Not Dated or Unclear
PRI 00684	12/27/94
PRI 00686	Not Dated or Unclear

TAYLOR LITERATURE

BROCHURES

BROCHURE INDEX

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6	Oxy-Dry 2 Roll Blanket Coater	1987
7	Dahlgren - Product Data Dahlgren Blanket Coater	Approx. 1988+
8	Pictures of Rapidac Blanket Coater	Late 80's or early 90's
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10	Dahlgrens New Lithoplus Coating System	Dated 1990
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W018867

1

The Versatile
Two in One

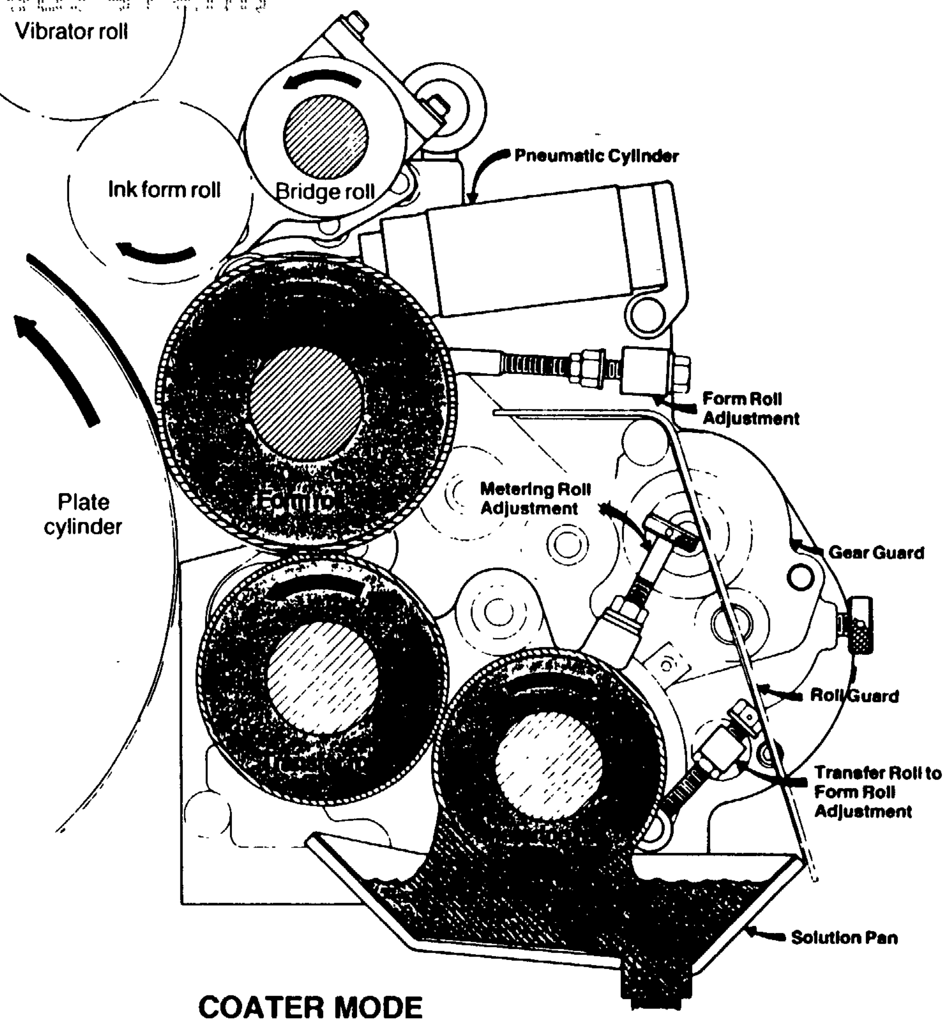
DAHLGREN®
Coater-Dampener

FINGERTIP CONTROL
IMMEDIATE RESPONSE
CONTINUOUS-DUTY OPERATION
PRECISION LATERAL CONTROL
SIMPLICITY IN MECHANICS & SETTING

SOLUTIONS THROUGH MEASUREMENT

DAHLGREN
Coating System

The Dahlgren converts from a dampener to a coater in a matter of minutes. You need only choose the mode of operation. In the coater mode of operation the bridge roll is pulled away from the ink form roll. This allows the **DAHLGREN®** form roll to deposit a metered amount of acrylic coating solution to the entire surface.

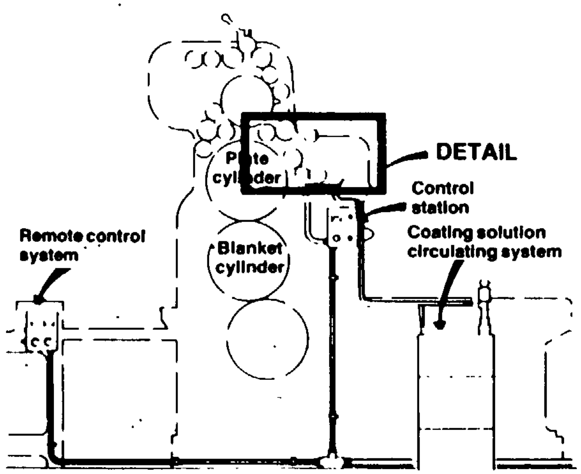


COATER MODE

DETAIL

LEGEND

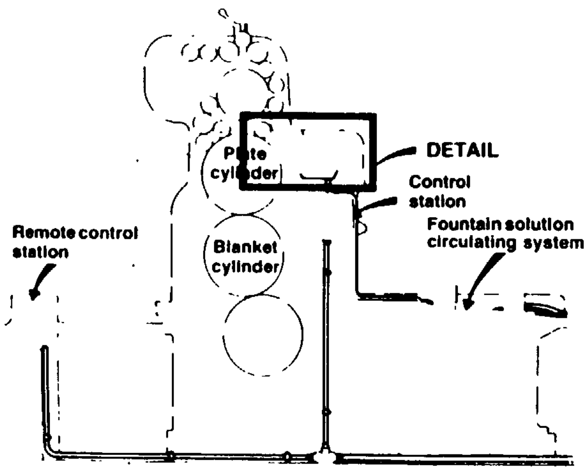
- Coating Solution
- Press
- Dahlgren Equipment



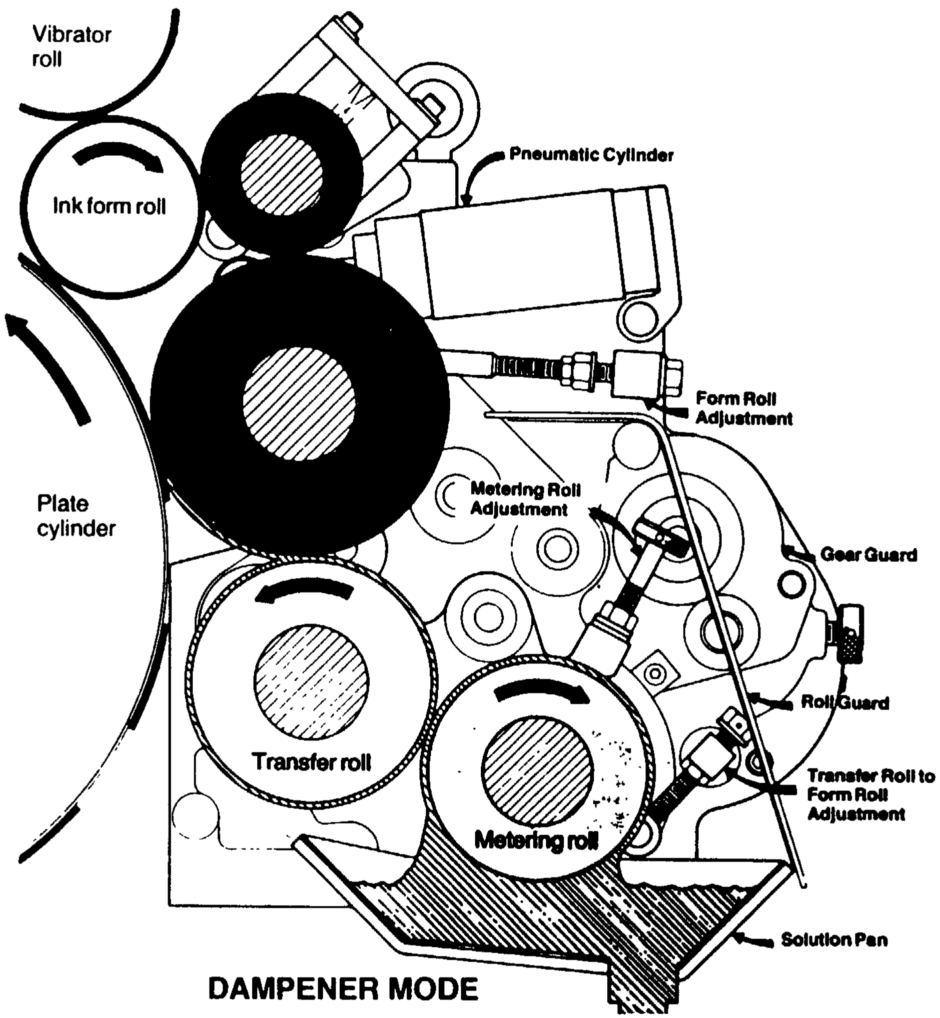
COATER MODE

DAHLGREN
Dampening System

The DAHLGREN® converts from a coater to a dampener in minutes. You need only choose the mode of operation desired. In the dampener mode of operation there is an extra inking form roll running against the plate cylinder.



DAMPENER MODE



DAMPENER MODE

DETAIL

LEGEND

Ink

Fountain Solution

Press

Dahlgren Equipment

... other...
... will equal or exceed the
... conventional manner.

...LGREN® Company reveals the following:

Odor
The test panels were found to contain no odor due to the coating. Nor was there any odor absorbed by the client's product itself. There is however, a slight aroma on a freshly coated sheet that dissipates as the coating ...

Grease Resistance
Acrylic coatings are quite resistent to soilage due to fingerprints or other oily base substances that may come into contact with ... finish for a short term as can be expected in normal handling.

Blocking
The coating will not block at normal or elevated temperatures typical of those encountered in warehousing or shipping.

... Resistance
... will withstand normal, short-term ... exposure which may be experienced ... kitchen or a laundry, without serious damage.

... Angle
... slip angle of the acrylic coating, as measured by the coefficient of friction method, indicates a 17 to 18 degree slide angle.

Stamp Acceptance
The coating will accept price stamping within hours after its application, with no smearing or wipe-off after only 20 seconds of drying time.

DAHLGREN
MANUFACTURING COMPANY

3305 Manor Way, Dallas, Texas 75235
in Texas and Canada tel (214) 357-4621
Toll Free 800-527-4684
Telex 73-0329 Dahlgren Dal

1-19-3 Nishi-Shinbashi
Minato-Ku
Tokyo - Japan
Tel (03) 501-1301
Telex 02225441

172 Sterrebeekstraat
B-1930 Zaventem Zuid 7
Belgium
Tel (02) 721.29 14 (3 L)
Telex 25604 Dahlbr B

- 100% elimination of offset spray powders ... a full color run.
- Housekeeping problems related to the usage of offset spray powder are ended forever for the packaging manufacturer, the label printer and most lithographers in general. There is no longer any reason for spray powders to dust off in the finished product line.
- The aesthetic appearance of sheets coated by the **DAHLGREN®** Coater-Dampener using an acrylic coating is dramatically enhanced. The rough gritty texture of conventional varnish-spray powder finishes are replaced by a noticeably smoother surface. The reason is quite apparent under an electron microscope, as it reveals all the 'peaks and valleys' created by varnish-offset spray methods of coating, while the acrylic coating applied with the **DAHLGREN®** Coater-Dampener is nearly smooth, except for the sheet grain and texture.
- Visual appeal of coated sheets is also improved, as no unsightly layer of offset spray powder appears on the surface of the product to detract from the optical values of the finish.
- The Coater-Dampener eleminates the wasted floor space that used to be taken up with drying skids for boards and sheets coated in the old-fashioned way with varnishes and offset spray powders.
- The same machines, set-ups and stacking procedures may be utilized as before for cartons and/or sheets.
- The need to leave glue flaps uncoated as with conventional coating methods is eliminated with the **DAHLGREN®** Coater-Dampener.
- In line coating is now a reality, thanks to the **DAHLGREN®** System. Subsequent finishing operations can now be performed within a matter of hours after the coating is applied.

Printed by Intenso Offset BV Amsterdam, with Dahlgren Dampening System

WC18872

2

DAHLGREN®

DAMPENER DIVISION

World Leader for more than twenty years in Graphic Arts Technology and Equipment

- **HIGH PERFORMANCE PUBLICATION WEB DAMPENERS**
- **DAMPENING SYSTEMS**
- **COATER-DAMPENING SYSTEMS**
- **LIQUID APPLICATION SYSTEMS**

Products are custom designed and manufactured to meet the customers needs.

WORLD WIDE PERFORMANCE AND SERVICE WARRANTY

Domestic and Foreign Patents Issued and/or Pending.

FOR FURTHER INFORMATION WRITE OR CALL

DAHLGREN®

DAHLGREN MANUFACTURING COMPANY

3305 MANOR WAY, DALLAS, TEXAS 75235

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TOLL FREE 800-527-5301

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STERREBEEKSTRAAT 172
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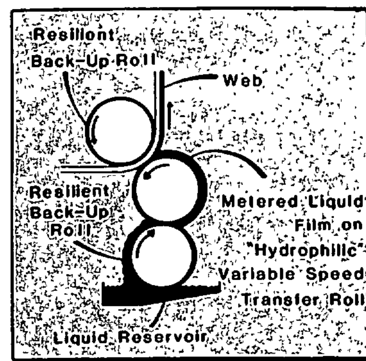
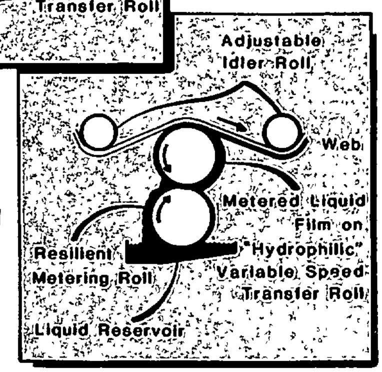
(BRUSSELS), BELGIUM
TEL: 721-29 14
TELEX: 25-604 DAHLBR B

No. 2 FUTABA BLDG.
19-3 NISHI-SHIMBASHI
1-CHOME MINATO-KU
TOKYO, JAPAN
TELEX: 781/2225441

Liquid Application System (LAS®)



Coating Application



Moisturizing Application

Capabilities of the Dahlgren Liquid Application System

The system can apply a broad range of aqueous and non aqueous coatings at previously unachievable light functional coat weights. It maintains constant linear thickness throughout its entire speed range When changing web speeds it is not necessary to adjust the viscosity of the coating solution. Varying web widths can be run on the same unit without encountering edge build-up.

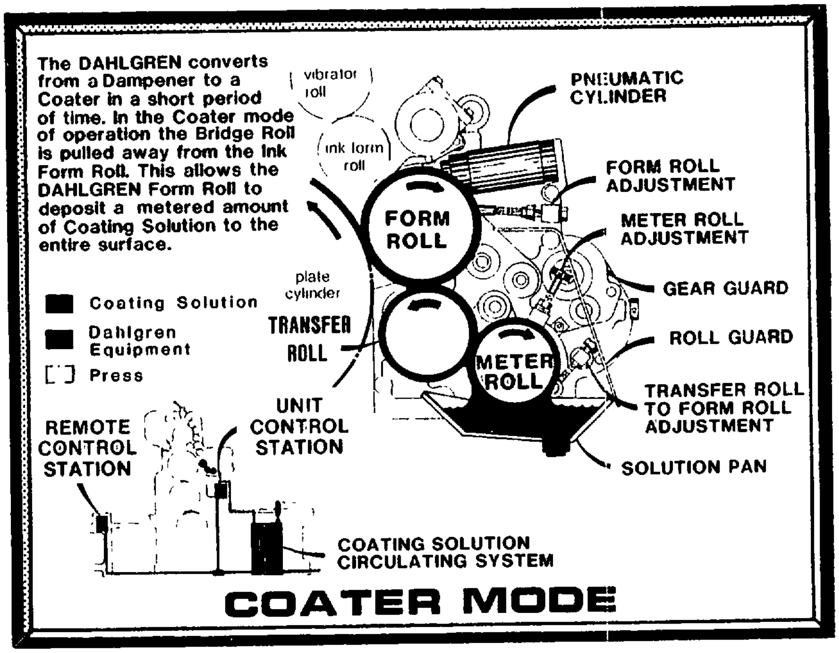
Control of the applied coat weight is within 1% Also, the system offers better control of the penetration of materials and coat weight remains the same regardless of sheet variations.

Changing from one coating material to another is a fast and simple operation Training operators is easy compared to the training required for other coating equipment

The Dahlgren Liquid Application System can be applied to many paper-making and converting functions — such as moisture profiling, decurling, surface coating, controlled penetration coating, high solid starch applications and other difficult and costly operations.

W018874

Coater-Dampener System



- 100% elimination of offset spray powders on a full color run
- Housekeeping problems related to the usage of offset spray powder are ended forever for the packaging manufacturer, the label printer and most lithographers in general. There is no longer any reason for spray powders to dust off in the finished product line.
- Visual appeal of coated sheets is also improved, as no unsightly layer of offset spray powder appears on the surface of the product to detract from the optical values of the finish
- The COATER-DAMPENER eliminates the wasted floor space that used to ~~be~~ taken up with drying skids for boards and sheets coated in the old-fashioned way with varnishes and offset spray powders.
- The same machines, set-ups and stacking procedures may be utilized as before for cartons and/or sheets

Characteristics of the acrylic coating as applied by the

Dahlgren Coater-Dampener . . .

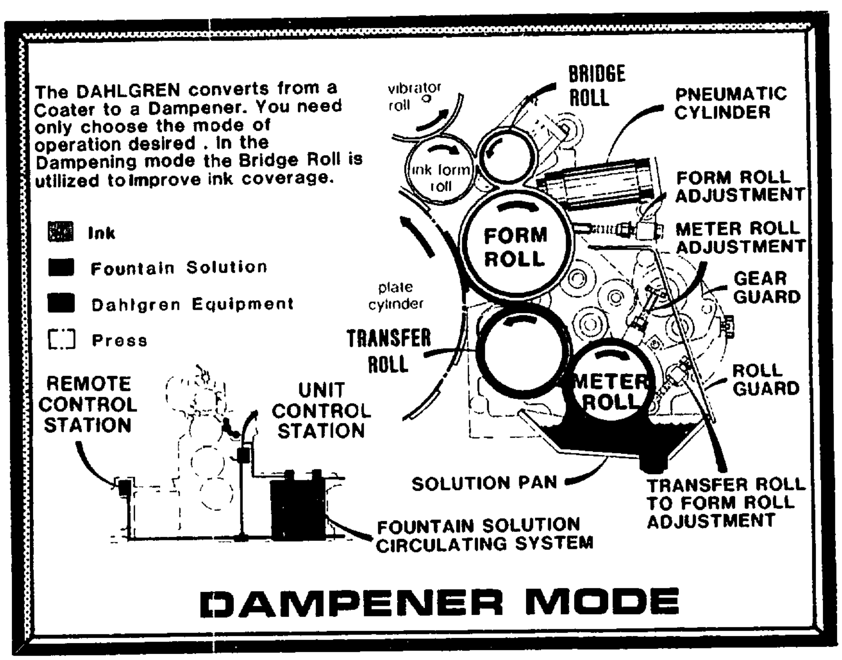
Gloss

Acrylic coatings applied with the COATER-DAMPENER will meet or exceed meter tests for varnishes of the same thickness

Coatings applied by the DAHLGREN SYSTEM provide superior glue ability, even though applied over the entire sheet 100% fiber tear is experienced with water based adhesives or hot melts This proves the adhesive bond is stronger than the paper substrate itself Conventional varnish or spray powder finishes must be applied only over the printed area as they have a negative effect on glueability

COATER DAMPENER applied acrylic coatings do not yellow when exposed to ultraviolet of sunlight, while conventional varnishes are quite susceptible to yellowing

In bending test the acrylic coating did not crack on scored lines when the paper product was folded and set up



3

IBC Blanket Coating System

IBC

W018877

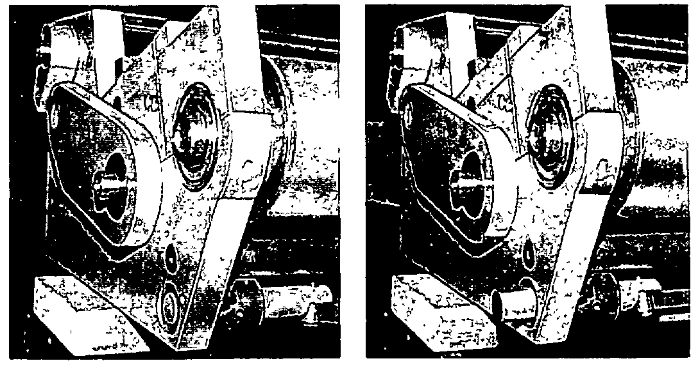
When you want the full-line on in-line, talk to IBC.

We urge you to look closely into a "first." The IBC Blanket Coating System. It is the first blanket coating system to efficiently apply today's coatings *in-line.*

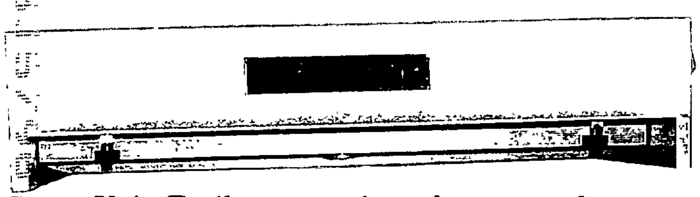
Its major components consist of a blanket coater with recirculating tank and a shortwave infrared dryer. It adapts to almost any sheetfed press, any make, in any size from 18 to 77 inches.

It is also the only in-line system with a retractor unit. The retractor lets you automatically change from printing to coating, and vice versa, in a matter of minutes.

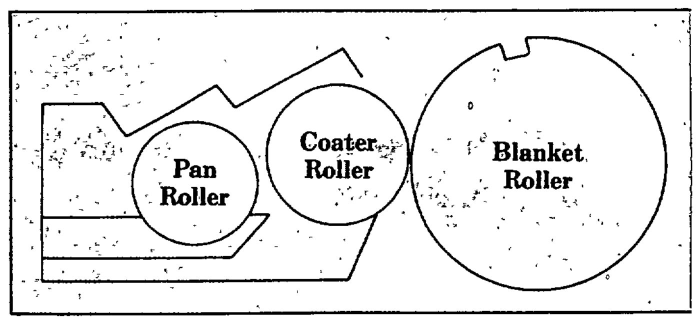
The IBC System is a real timesaver in several ways. No plate mounting is ever called for, which of course means no plate washing on trip-offs either. Thirty-minute make-readies are the rule, not the exception. And the IBC System comes with its own blanket washer that can be manually operated to wet the blanket; or it can be set to automatically wash the blanket on trip-offs – again saving you time.



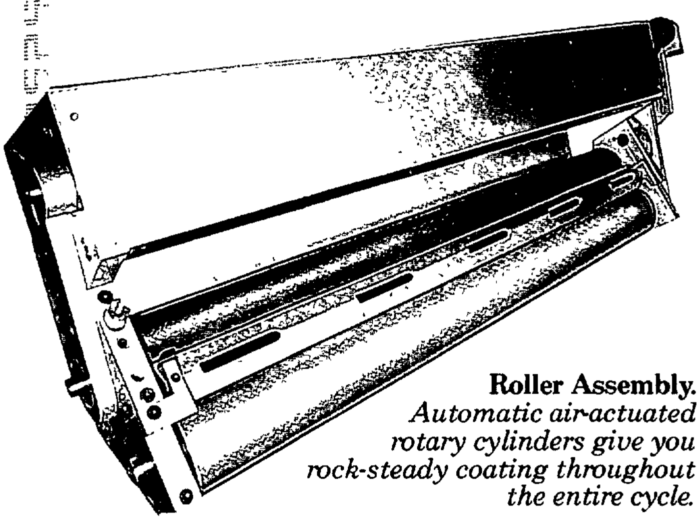
Easy Operation. *Automatic air actuated engages the coater unit to the press. Photo at left shows pins disengaged.*



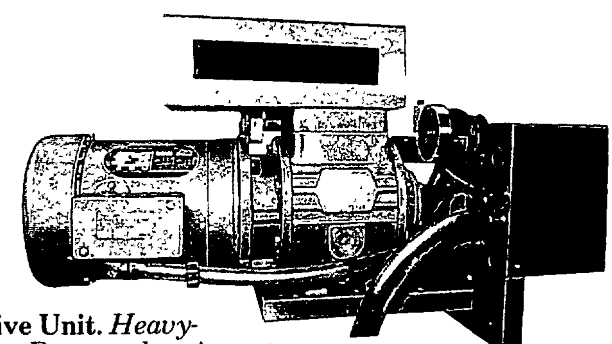
Coater Unit. *Easily retracts from the press and reconnects with all settings fully retained.*



Simple Mechanics. *Once the press is tripped, the coater automatically withdraws and goes into an idle mode keeping the rollers wet.*



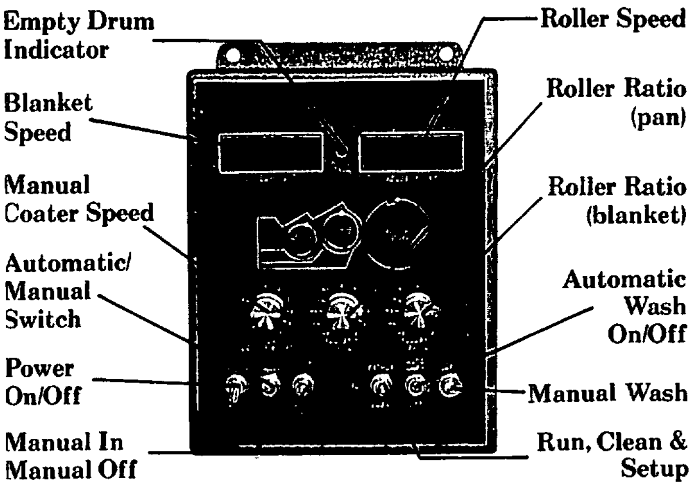
Roller Assembly. *Automatic air-actuated rotary cylinders give you rock-steady coating throughout the entire cycle.*



Drive Unit. *Heavy-duty Dayton electric motor is coupled with a durable, high torque transmission.*

The IBC System's coater roller (composed of a harder-than-steel ceramic material) is driven by a variable-speed, constant-torque transmission. It allows you to run the coater roller up to 25% slower than the blanket cylinder. Any ridging is eliminated. You get a super smooth coating.

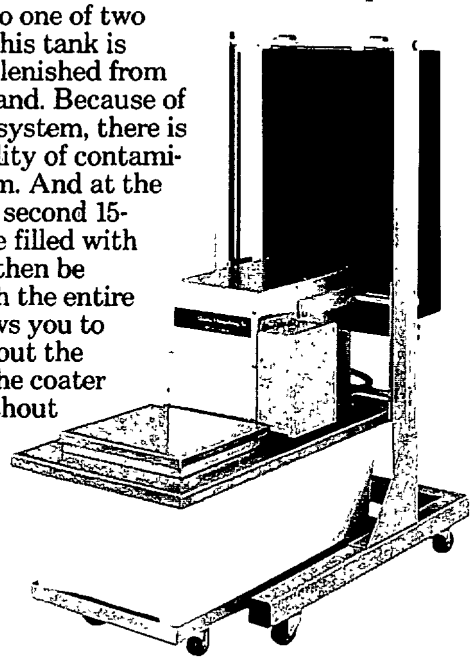
Constant operating speeds are maintained by the heavy-duty Dayton electric motor. And you get positive power through all speed ranges, because the motor is directly linked to the high-torque transmission. No DC belt-drive, like on most other coaters. All you do is set up the initial roller speed from the control panel, and then fine-tune as you run. Faster, slower, whatever speed you set, the coater will follow automatically.



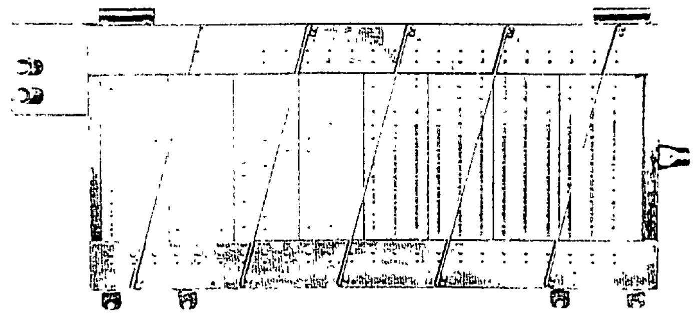
Control Panel. *Gives you infinite speed control and two wash-up options.*

Easy-to-read LCD displays on the control panel tell you how fast the coater roller and blanket cylinder are running. also, the control panel is easy-to-reach, conveniently located on the operators side of the p at the coater position.

The IBC System is also equipped with a recirculating tank unit. It is this component of the system that continuously replenishes the coater via flexible plastic hoses connected to one of two 15-gallon tanks. This tank is automatically replenished from the drum on demand. Because of this replenishing system, there is never any possibility of contamination to the drum. And at the end of each run, a second 15-gallon tank can be filled with water, which can then be circulated through the entire system. This allows you to thoroughly flush out the recirculator and the coater automatically without ever having to change the solution in the first tank.

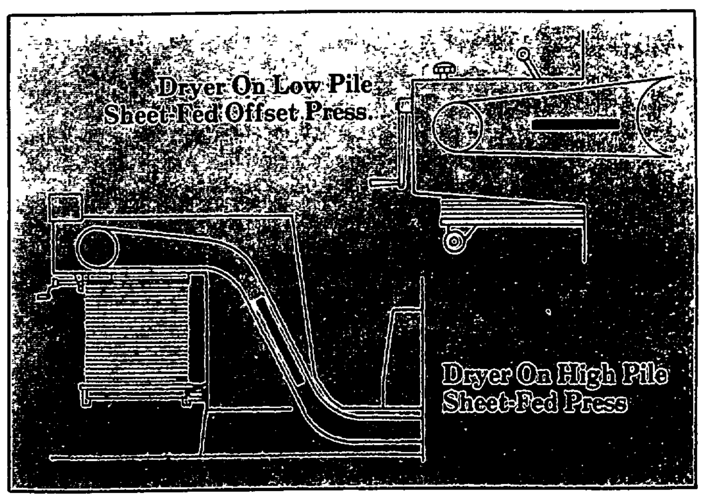


Recirculating Tank Unit. *Sets on wheels, so you can place it anywhere near the coater and still keep it out of the way.*



Infrared Dryer. *Safe, shortwave infrared energy is emitted from high-efficiency, low-mass, tubular quartz lamps.*

All IBC Infrared Dryers are custom-designed to fit specific presses for specific applications. Consequently, an IBC dryer can be installed on virtually all high-pile or low-pile sheetfed offset presses. No major press modifications are ever needed.



IBC Dryers, installed. *The IBC Infrared Dryer can be mounted parallel to the direction of sheet travel, between the gripper chains.*

Because of the lamps low mass, they reach operating temperature almost immediately and cool down equally as fast. Whenever the IBC dryer is on, an air supply system delivers a flow of cooling air across the lamp terminals to keep them cool. A thermostat inside the dryer's frame monitors the temperature and automatically shuts off the dryer if the temperature (for whatever reason) rises too high. Each IBC dryer comes with an air knife bar for drying aqueous coatings. Optional dryer equipment includes a water-cooled reflection pan and sheet cleaners for some presses.

Aquacoat™ Water-Based Coating

Bring high-gloss beauty to your printing with Aquacoat™ water-based coating.

It gives paper and paperboard a good moisture-barrier, high grease-resistance and superior rub characteristsics. Yet, it has no effect on the important paper qualities, such as color, strength or flexibility. And it is also bio-degradeable.

Aquacoat coating is permanent and fast drying. Apply it wet-on-wet or on dry ink. It is also glueable, imprintable, and can be price marked.

Aquacoat coating keeps packages clean and protects them from abrasion through finishing, packing, shipping, storage – all the way to the point-of-purchase. And even while the customer uses it, the product stays clean and fresh-looking.

Use Aquacoat water-based coating for cartons, trays, bags, labels, coupons, wraps, laminates, brochures and covers.

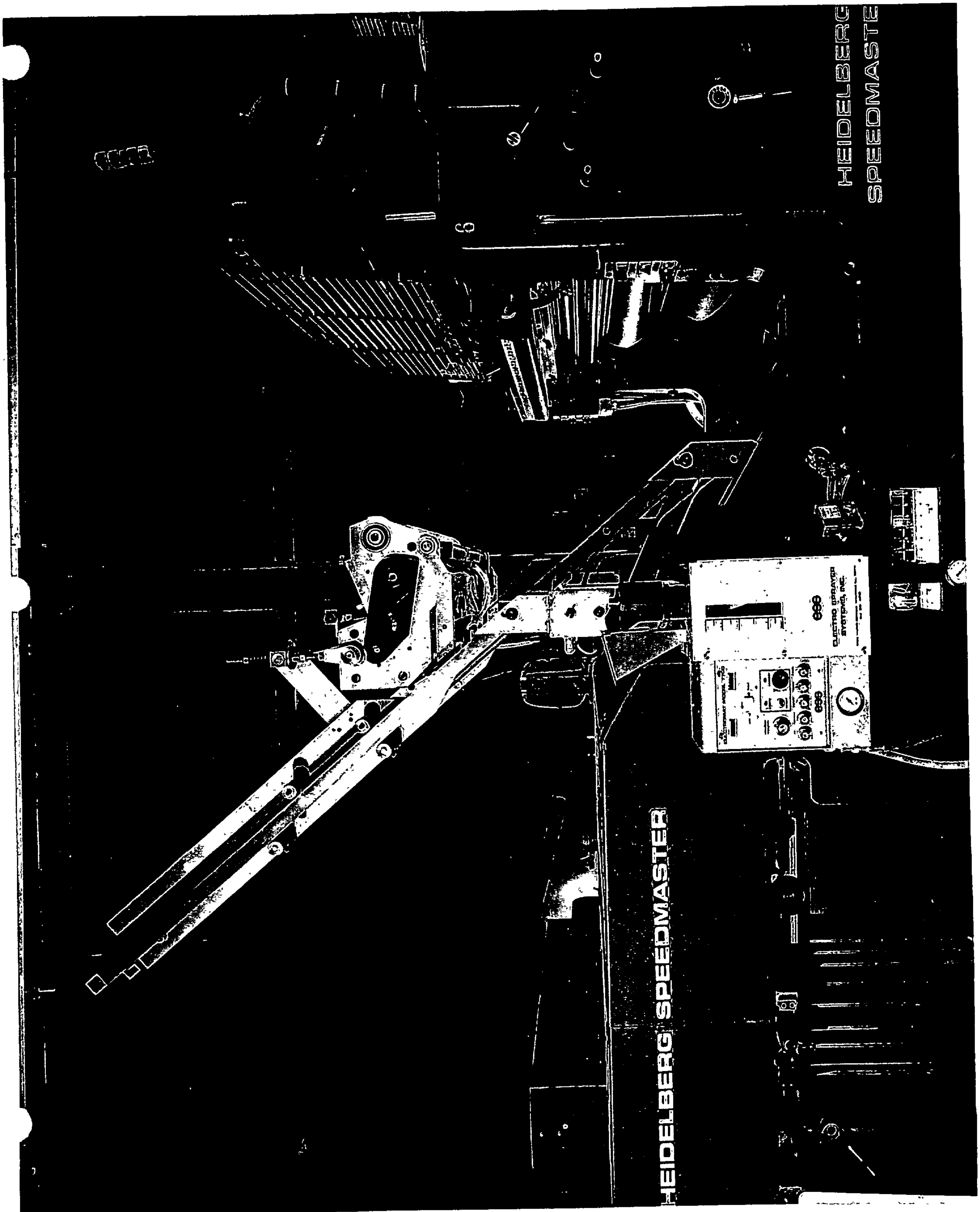
If you'd like to know more about Aquacoat coating or our full-line of in-line blanket coating components, please call us.

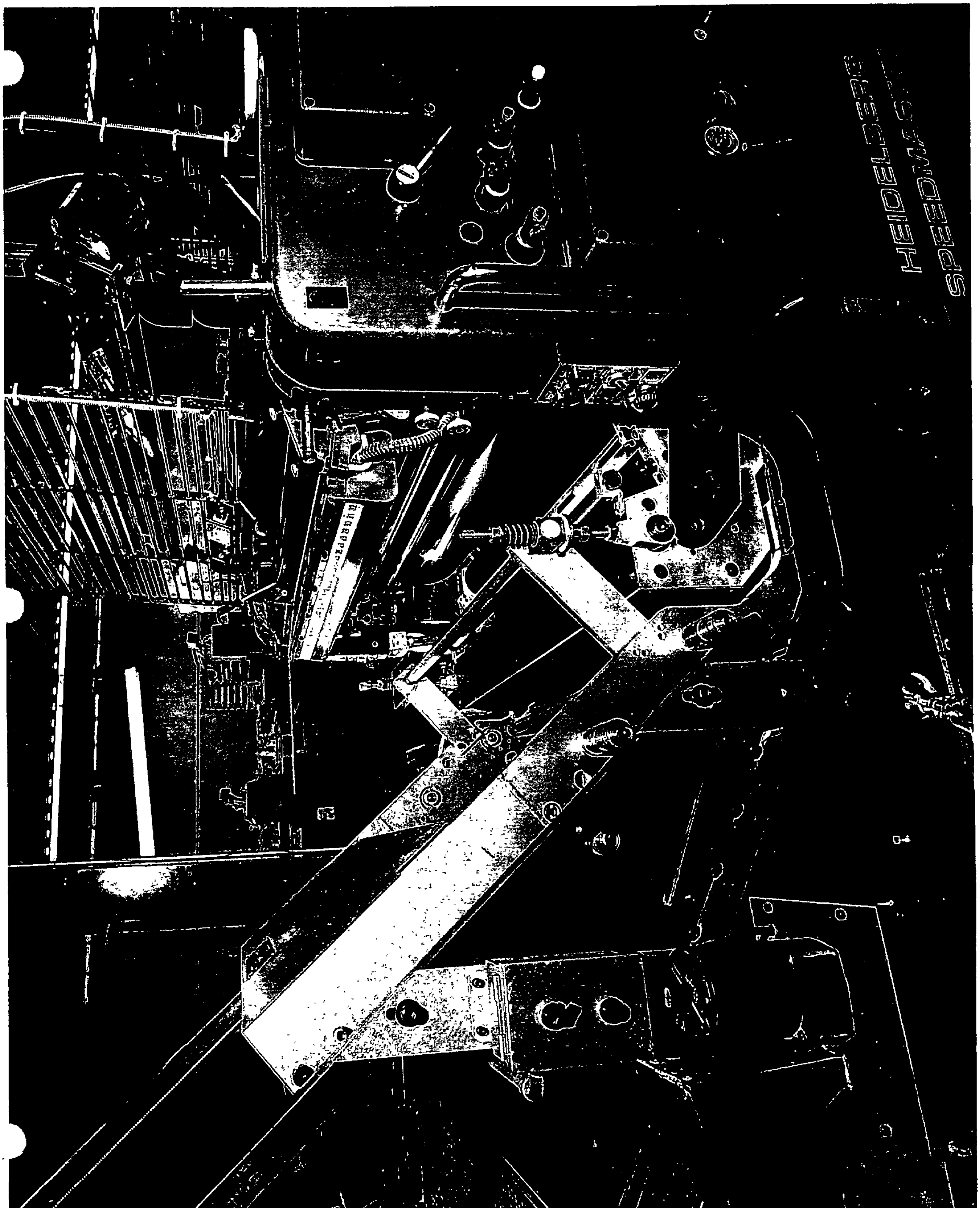
We'd be happy to hear from you.

W018880

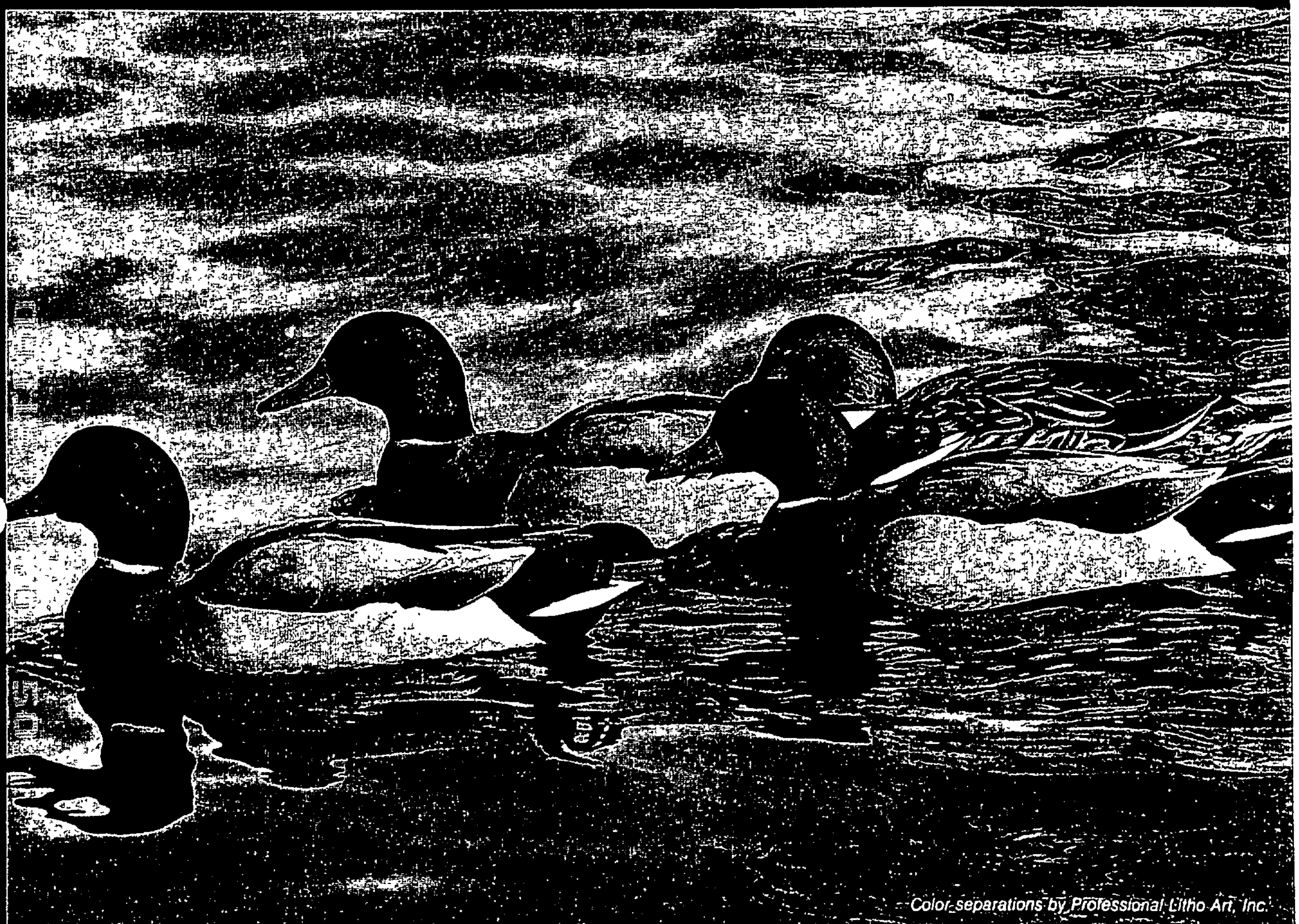
IBC
INTERNATIONAL BLENDING CORPORATION
8090 Ranchers Road • Minneapolis, Minnesota 55432 • Phone: 612/780-5377

Printed in USA


HEIDELBERG SPEEDMASTER
HEIDELBERG SPEEDMASTER


HEIDELBERG
SPEEDMASTER

AQUACOAT

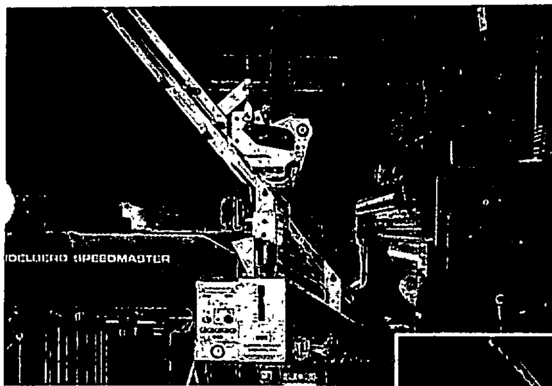


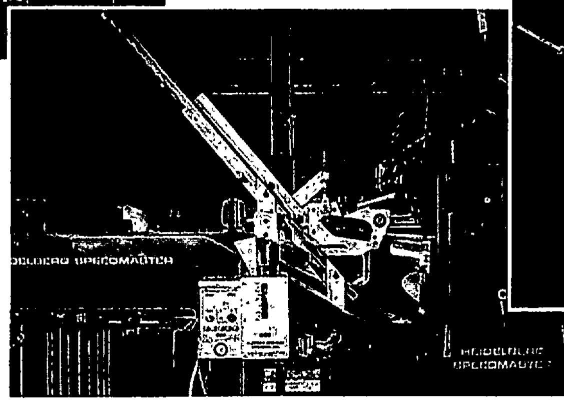
What you see is beautifully protected by Aquacoat.™
To see how it was applied in-line, just turn the page.

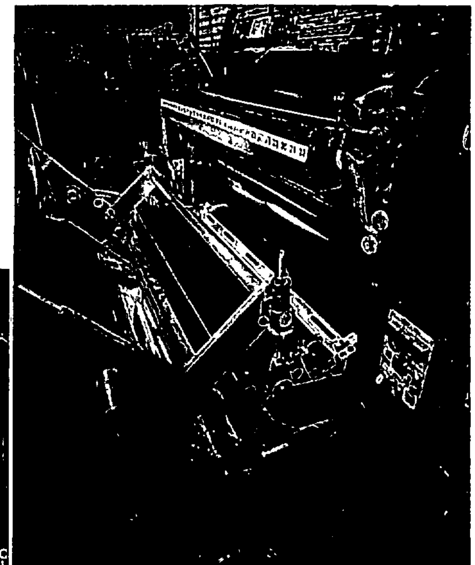
IBC

Artist: Tom Gross, "Mating Mallards"
Ask for details on how you can receive a signed proof of this award winning art, "Mating Mallards".

W018883







Come to IBC— the Coating Systems People.

The IBC/Ryco Graphic In-Line Blanket Coater

IBC/Ryco Graphic is the first—the first blanket coating system to efficiently apply today's coatings *in-line.*

You can install the IBC system on almost any press, any make, from 18 to 77 inches. When you're not coating, simply retract the coater for easy access to the blanket cylinder.

The independently driven pan roller and coater roller can be fine tuned to run faster, slower, or the same speed as the blanket cylinder. An LED display tells you how fast the coater roller is running; once it's set, the coater will always follow press speed.

A 15-gal. recirculating tank continuously replenishes the coater. Because the tank unit sets on wheels, you can place it anywhere near the coater and still keep it out of the way. In fact, you get an extra tank with the system, so you can flush out the press and the system without changing solution in your coating tank. (Its low profile lets you mount the coater on any high-low offset press.)

No plate mounting is necessary with the in-line IBC/Ryco—in fact, ten-minute make-readies make the IBC/Ryco Graphic Blanket Coater a real time saver compared to others. It comes with its own blanket washer that automatically washes the blanket on trip-offs—again saving you time.

IBC Infrared Drying Equipment

The IBC Dryers are manufactured to exacting engineering specifications to perform well with the IBC Coating System. The dryer comes equipped with an air knife bar necessary for drying aqueous coatings. The IBC Dryer uses air cooling and thermostats to protect both the dryer and the press it 's mounted on. IBC offers a water cooled reflection pan if desired. IBC also offers sheet cleaners for some presses.

Printed and coated by Jet Press, Inc., Downers Grove, Ill., on a 40" 6/C press with an IBC Coating System.

Aquacoat™ Water-Based Coating

You can bring high-gloss beauty to your printing with Aquacoat™.

Aquacoat™ gives paper and paperboard a good moisture-barrier, high grease resistance, superior rub characteristics and is non-yellowing. Yet, it has no effect on the important paper qualities of color, strength or flexibility.

Aquacoat™ is permanent and fast-drying—apply it wet-on-wet or on dry ink. It's also glueable, imprintable and can be price marked. Uses include cartons, trays, bags, labels, coupons, wraps, laminates, brochure and covers.

Aquacoat™ keeps packages clean and protects them from abrasion through finishing, packing, shipment, storage, all the way to the point-of-purchase. And even while the customer uses it, the product stays clean and fresh-looking.

Yes, tell me more!

Send me more information about the:

- ☐ Aquacoat™ Water-Based Coating
- ☐ Ryco In-Line Graphic Blanket Coater
- ☐ IBC Dryer
- ☐ I am interested in the total IBC System.
- ☐ Please have your sales representative call me.

Name ______________ Title ______________
Company ______________
Address ______________
City ______________ State ____ Zip ______
Phone ______________
Press Size ______________

Write to:

International Blending Corporation

IBC

8090 Ranchers Road
Minneapolis, MN 55432
Phone: 612/780-5377

W018884

~~Peters~~
Taylor

RYCO GRAPHIC MANUFACTURING, INC.

ROLLER COATER

SET-UP PROCEDURE

COATER

SET-UP PROCEDURE

1) Put coater rack in down position & lock by pushing.

2) Push down button, making sure coater air cylinder rods clear coater safety rack.

3) Be sure coater sets on wheels when contacting rails. First release front hoist hooks & move up out of way. Lower coater more until back hooks are free. Hold back hooks away and put hoist up at top. Hold up button until hoist stops.

4) Push coater into press: both sides equally. Be sure air cylinder shafts contact top 2" diameter bar. Put top of clamp blocks on. Reach under coater with tool & lock pins into frame brackets. Tighten clamp blocks by turning screws and drawing air shaft rods up. (Placing control on manual & set-up, then pushing & holding out switch will aid in tightening clamps.)
NOTE: *** Keep fingers clear when holding switch!!!

5) Put stand tube in pan, drum fill tube in drum, and return from recirculator in recirculator. Open lid. Turn green switch on to start recirculator.
NOTE: *** Power switch on coater control must be on and also run switch must be in set-up position.
Open fill valve on supply tube at coater.

6) When coating is flowing into drain in pan, put control from set-up into run position.

7) Adjust pan roller screw counter-clockwise evenly on both sides until coating on main roller is very thin but wet.

8) Put unit of press with coater on impression.
NOTE: Make sure coater control is switched to manual position before moving press.

9) NOTE: When packing blanket, be sure packing is cut to just inside sheet, about 1/8" each side.

10) Stripe blanket by setting run switch first to set-up and wait until roller stops. Then move in/out switch to in & hold for a second. Then release and hold out, release. Then return to run position. Move blanket cylinder around to inspect stripe.

11) If stripe is about 1/4" wide & wet all across, then run about 25 test sheets with press running slow. (see running)

IF STRIPE IS:	REMEDY
NOT SEEN (See Stop Block Adjustment)	Back out stop block adjustment (1) turn at a time, both sides equally.
HEAVY ONE SIDE (1/2" WIDE) NOT SEEN ON OTHER SIDE (See Stop Block Adjustment)	Back adjustment out on side with no coating and put (2) turns in on other.

W018886

IF STRIPE IS:	REMEDY:
1/2" WIDE ALL ACROSS (See Stop Block Adjustment)	Turn adjustment screws in (2) turns, both sides equally. (See Run)

12) Stop Block Adjustment:
Loosen top allen screw. Then turn large bolt in (clockwise) or out, depending on condition.
NOTE: Before re-testing, top allen screw must be very tight.

Each full turn of large bolt equals .010 of an inch movement of coater to blanket contact.

13) Running:
NOTE: When testing, take press unit off impression before putting coater control on Auto for Running.

14) When running, put coater roller #1 knob (center knob) at (1) at right of zero (0) to start. Set pan roller on (2) to keep coating circulation in NIP.

15) NOTE: Turn control knob for roller #1 (center knob) up to (2) or (3) if more coating is desired or gripper edge of sheet coating looks dragged or scuffed, about 1/4" back all across.

16) Clean-Up:
Pull stand pipe out, turn valve on fill tube off, take fill pipe out of coating from coating barrel, and return hose from recirculator. Put into coating drum. Then open grey valve.

17) VERY IMPORTANT:
Turn control for coater to clean position and immediately wet both coater rollers. Turn pan roller screws clockwise to back roller, away from main roller, about 6 turns, evenly both sides. With wet folded cloths, wipe full length very fast to pick-up any excess coating still on rollers.

18) VERY IMPORTANT:
Through entire clean-up, keep grey roller end plates wet with water (side against rollers), thus cleaning without removal.

19) Push whatever coating left in pan toward drain.

20) When recirculator has pumped all but about 1" of coating out of tub back into drum, remove tub and clean. Replace second tub with water--no more than 1/2 full.

21) VERY IMPORTANT:
Remove hose and barrel tube from drum and put into open lid in recirculator. Turn green switch on and let water pump through hoses for a couple of minutes. Turn grey valve off on recirculator hose. This will pump water up to the coater when supply tube valve on coater is opened.

22) VERY IMPORTANT:
Wash excess coating off everything with this water very completely. Then repeat this procedure with (2) more tubs of water. On last tub, turn valves off and leave recirculator setting in water.

23) VERY IMPORTANT:
Open lid on recirculator & see black or yellow looking tube on right. This is an electronic eye to keep coating at a pre-set level in tub. Bottom must not be scratched and must be very clean to work. Wash only with water and dry bottom after every use.
NOTE: Do not let eye sit in water-----about 1" below is fine.

4

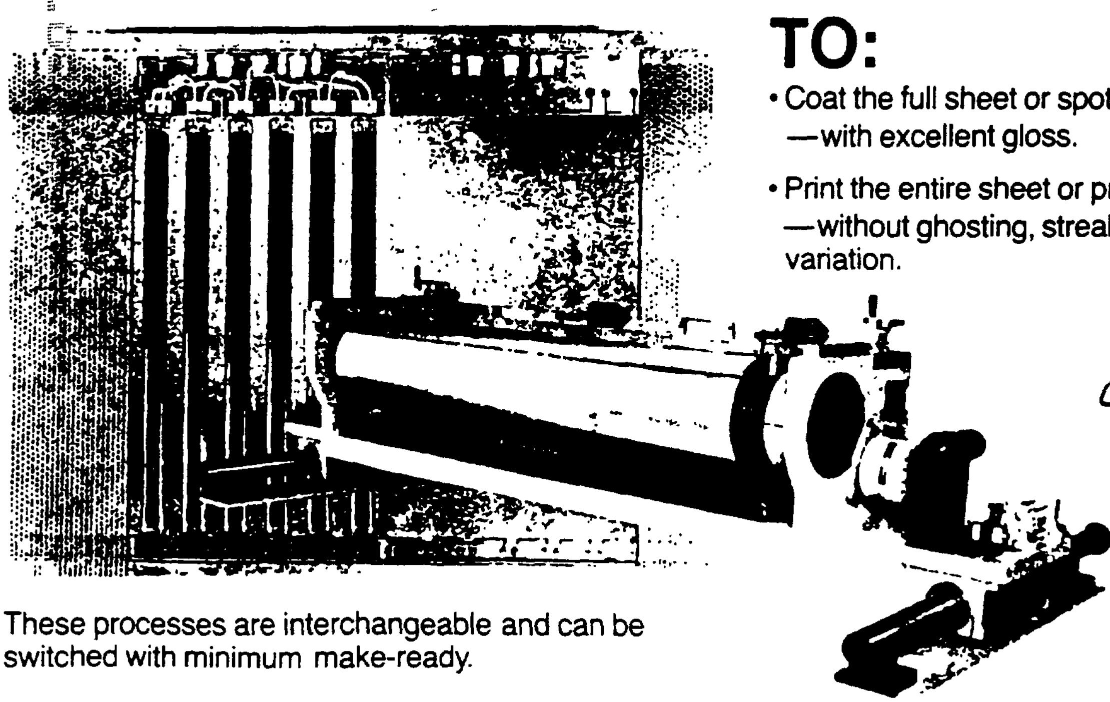
/35 Line
11X17

DAHLGREN®

COATER PRINTER

Two Processes In One!

The Dahlgren Coater/Printer is used in conjunction with the last printing station on a sheet-fed press.



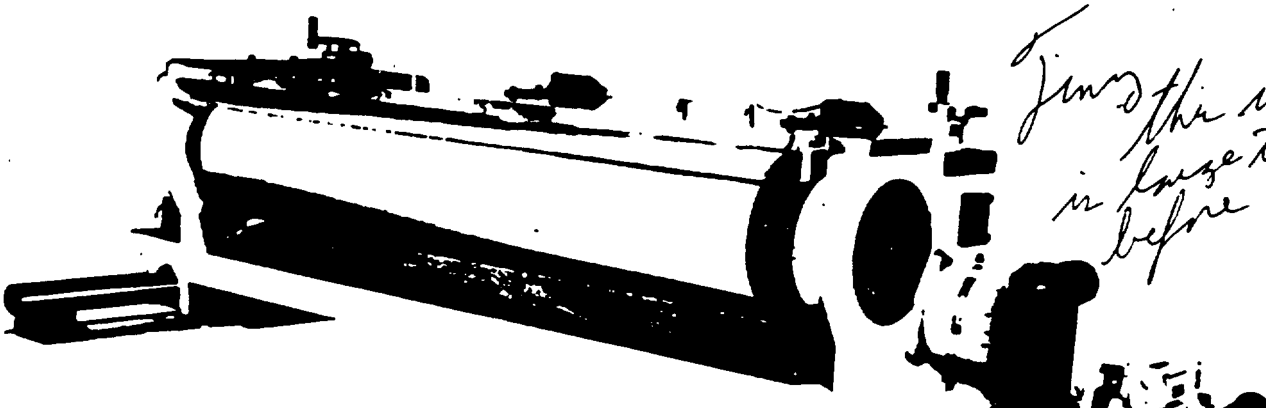
TO:

- Coat the full sheet or spot coat images —with excellent gloss.
- Print the entire sheet or print images —without ghosting, streaking or color variation.

These processes are interchangeable and can be switched with minimum make-ready.

The Coating Process: X

Jim, the image is larger than before



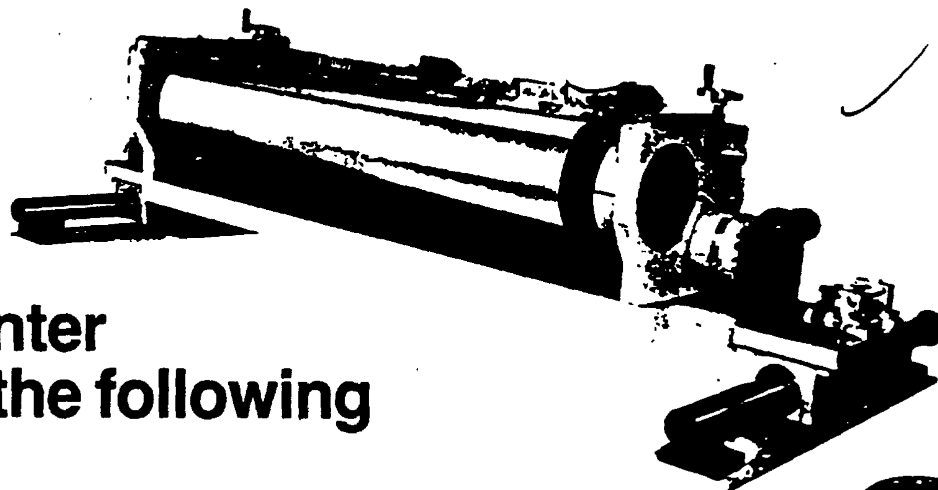
- Coatings are delivered to the offset blanket directly from an anilox roll in precisely controlled amounts and then transferred to the substrate with a high level of uniformity and consistency. It applies protective, high gloss and blister seal coatings over wet or dry surfaces with optimum efficiency.

- Various types of coatings can be used interchangeably with the Coater including aqueous and U.V. curables. Substrates of varying nature such as paperboard and plastics may also be used. Various combinations can be tested in Dahlgren's application lab to determine feasibility.

The Printing Process:

We are coating with color —with fantastic results!

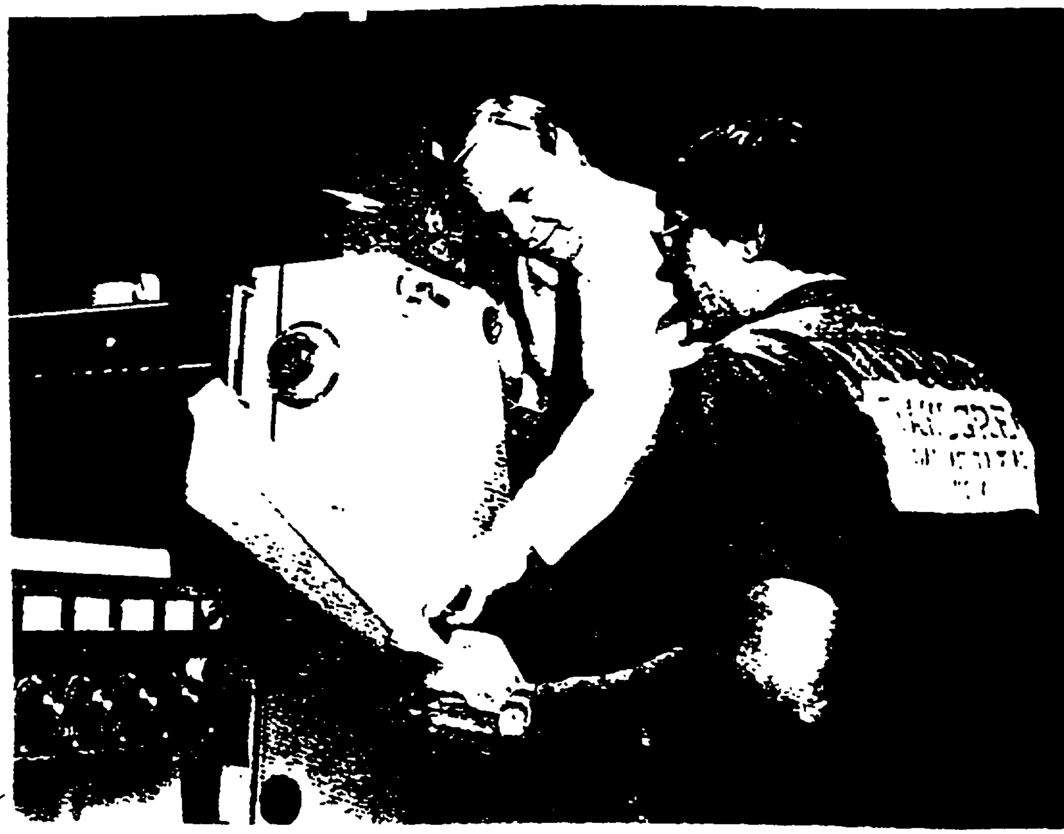
We're printing from a raised image resilient photopolymer plate. A doctor blade meters a continuous supply of ink to the anilox roll and plate with every revolution—*Totally* eliminating ghosting.



The Coater/Printer gives you the following benefits:

- Ghost-free printing.
- Smoother ink lay.
- Consistent and constant color.
- Immediate response produces instant color.
- Same color front-to-back and side-to-side.
- Drier printing.
- Runs *true* fluorescent and metallic inks.
- No hickeys.
- No ink keys.
- No color waste (3rd sheet saleable).
- No emulsification.

W018892



Dahlgren, the leader in technology and performance.

For the past three years Dahlgren has been expanding its products and services to service the changing needs of the commercial printer. The Coater/Printer evidences this commitment.

For all of the details on this remarkable new piece of equipment, contact your Dahlgren representative.

COATER PRINTER

DAHLGREN®
TECHNOLOGY/PERFORMANCE

Dahlgren International 3305 Manor Way
Dallas, Texas 75235 214/357-4621

W018893

5

DAHLGREN®

GROUPE DE VERNISSAGE BLANCHET

Presentation visuelle

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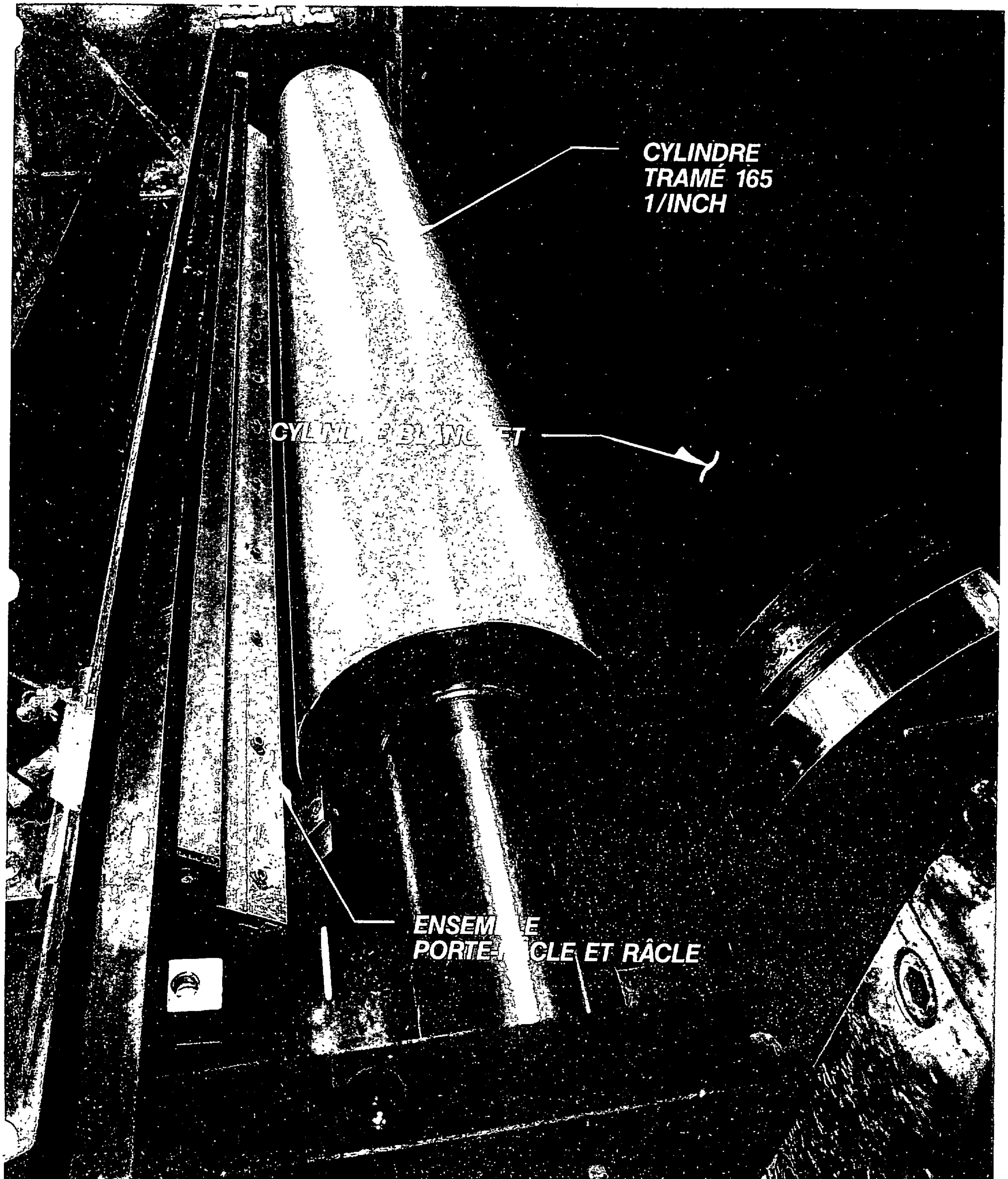

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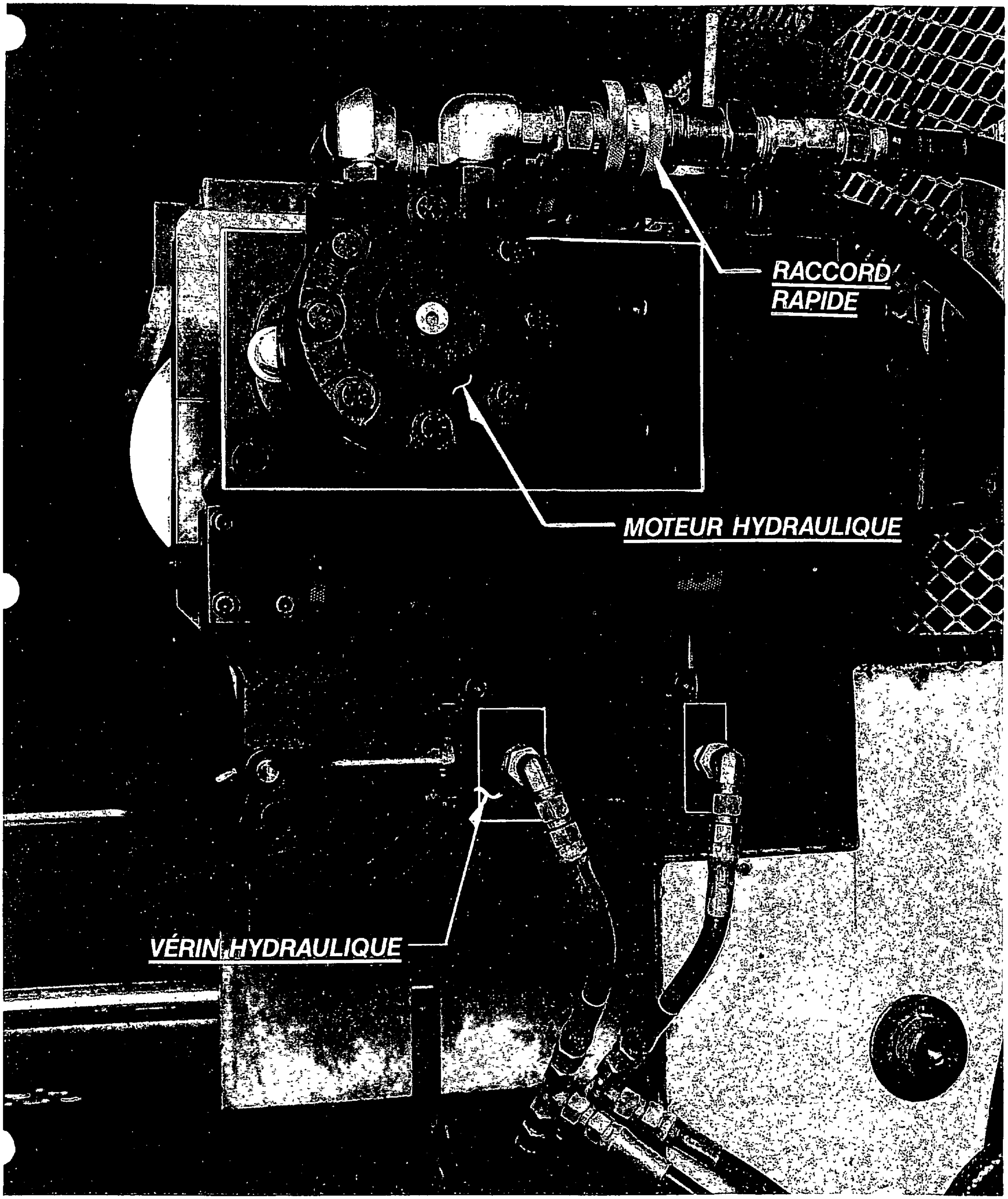

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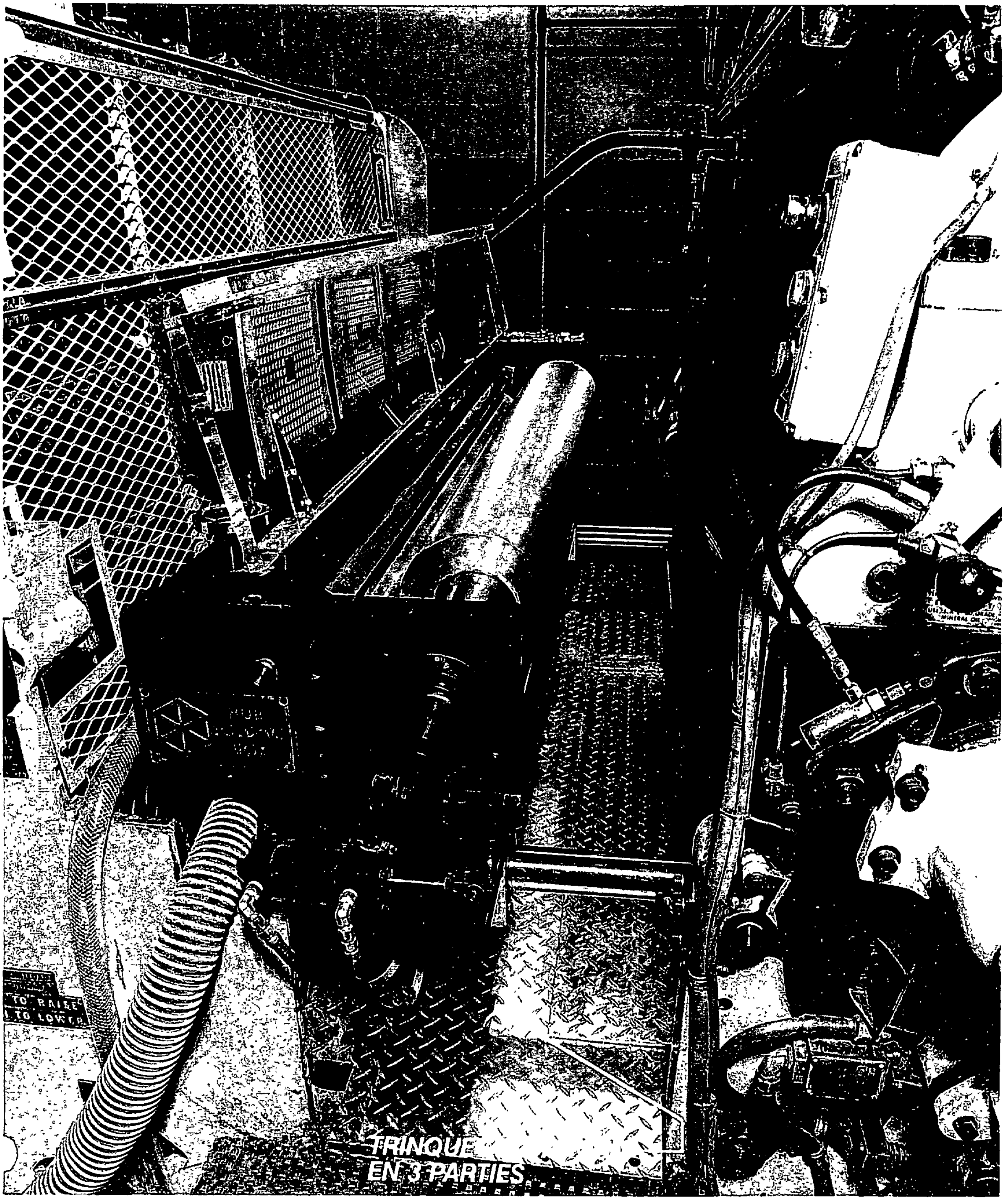

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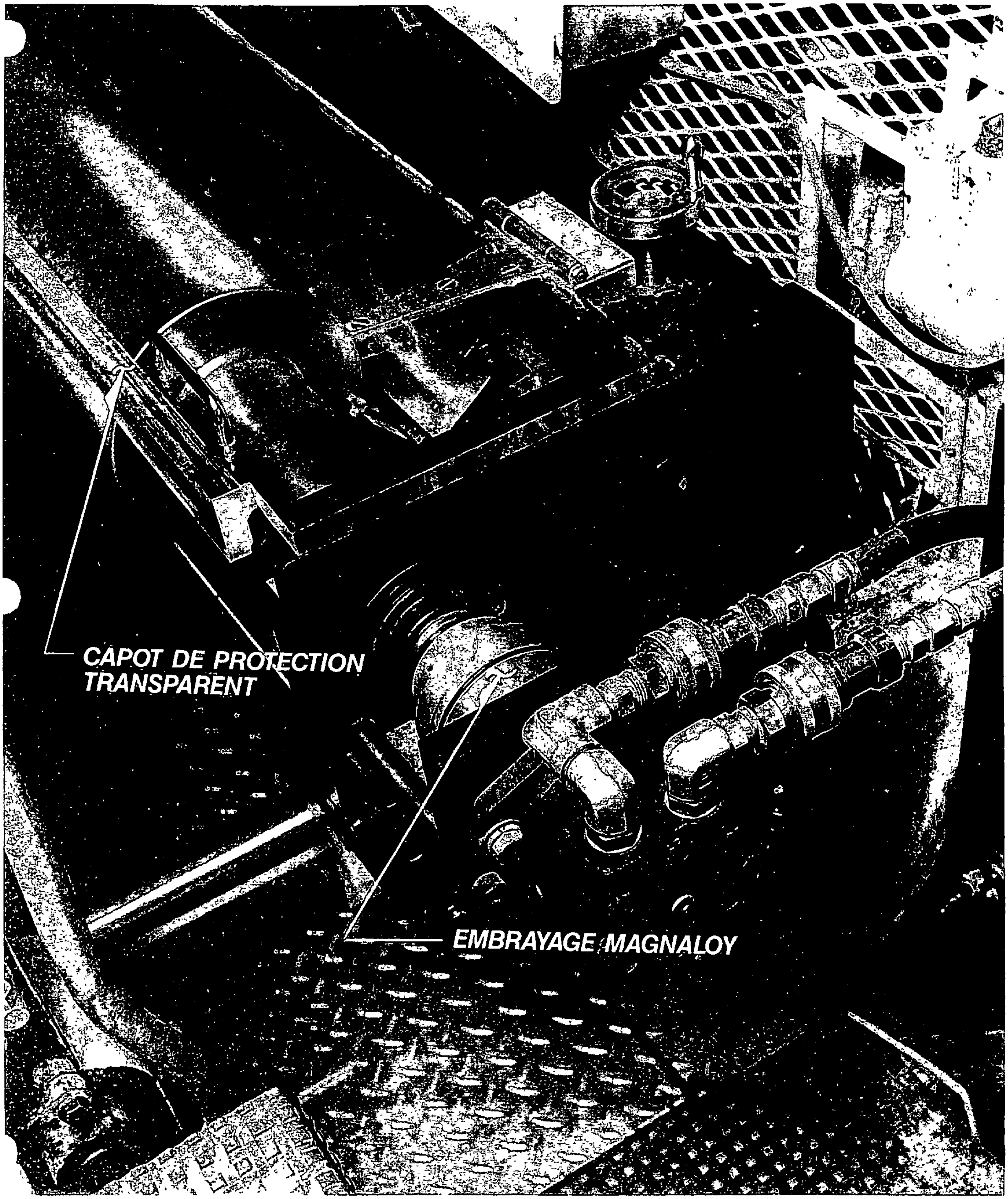

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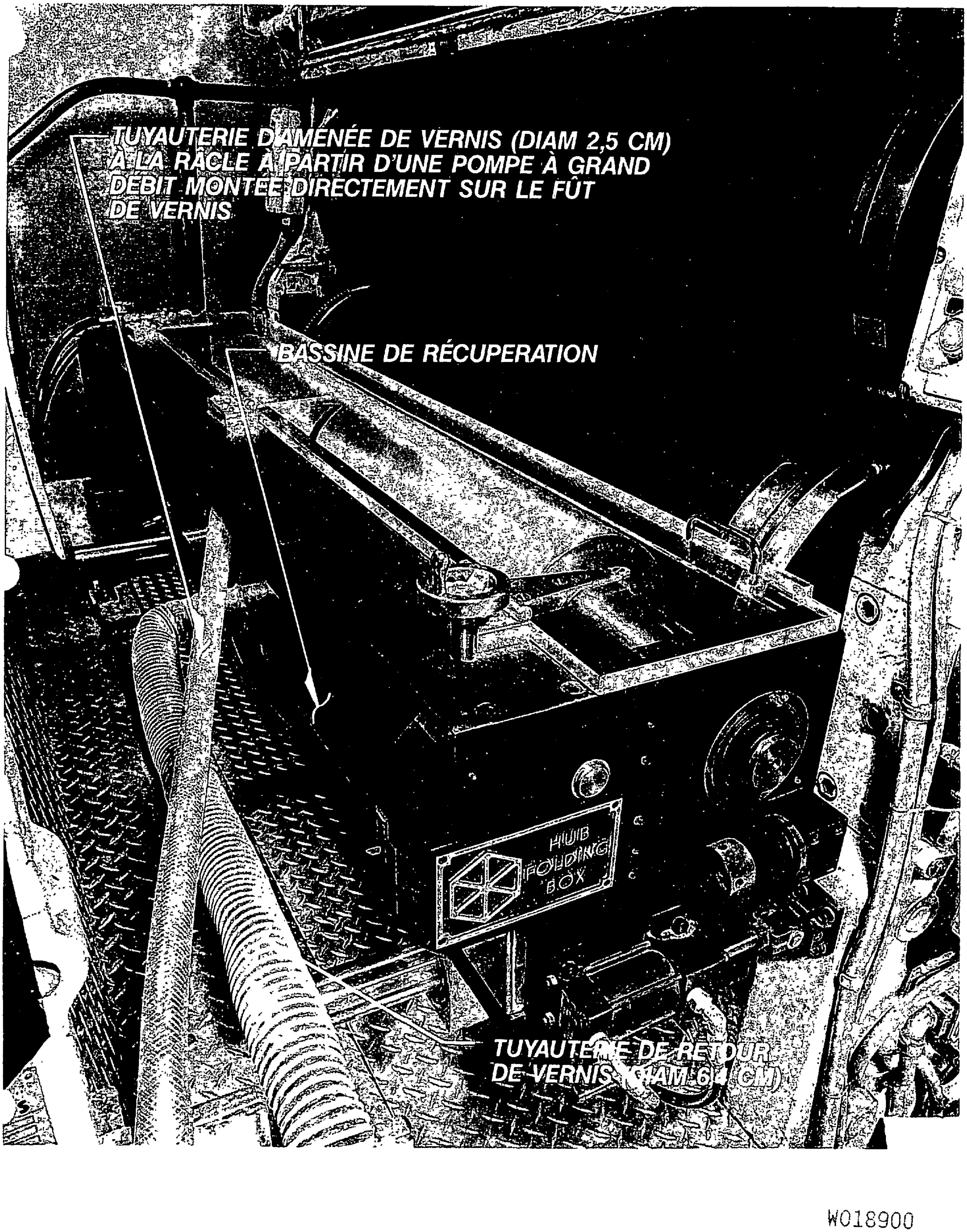
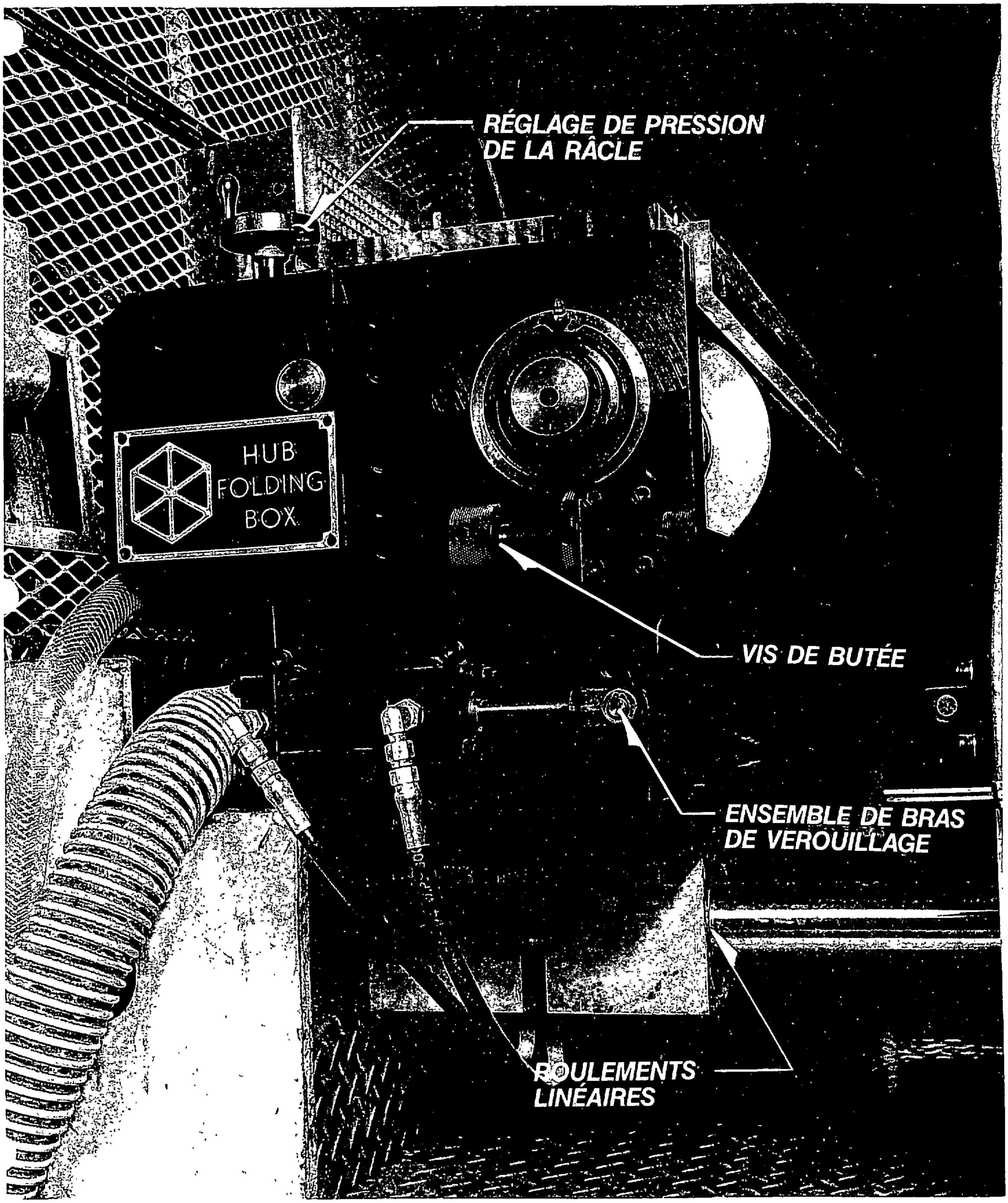
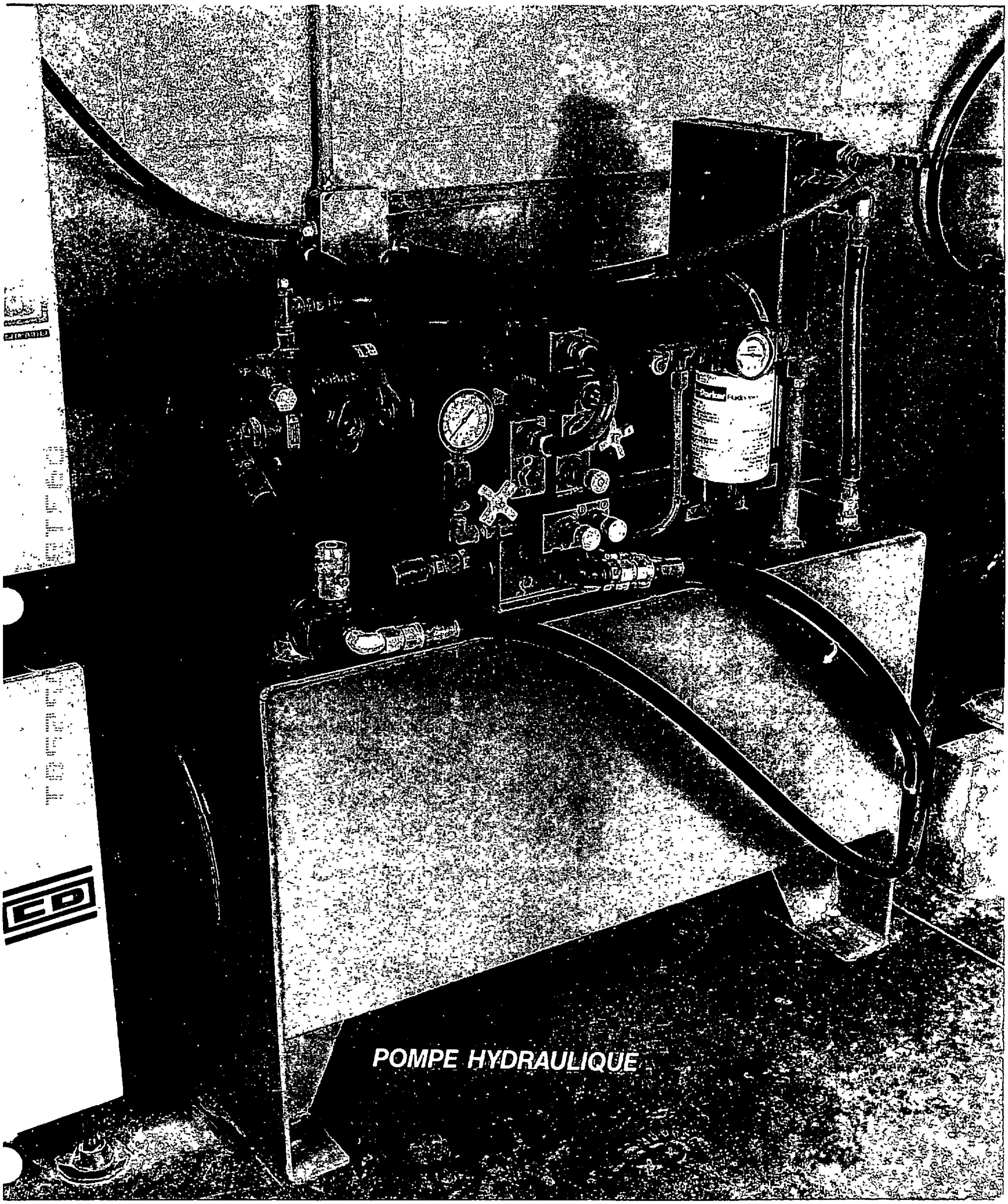

TUYAUTERIE D'AMENÉE DE VERNIS (DIAM 2,5 CM)
À LA RACLE À PARTIR D'UNE POMPE À GRAND
DÉBIT MONTÉE DIRECTEMENT SUR LE FÛT
DE VERNIS
BASSINE DE RÉCUPERATION
HUB
FOLDING
BOX
TUYAUTERIE DE RETOUR
DE VERNIS (DIAM 6,4 CM)


RÉGLAGE DE PRESSION
DE LA RÂCLE
HUB
FOLDING
BOX
VIS DE BUTÉE
ENSEMBLE DE BRAS
DE VEROUILLAGE
ROULEMENTS
LINÉAIRES

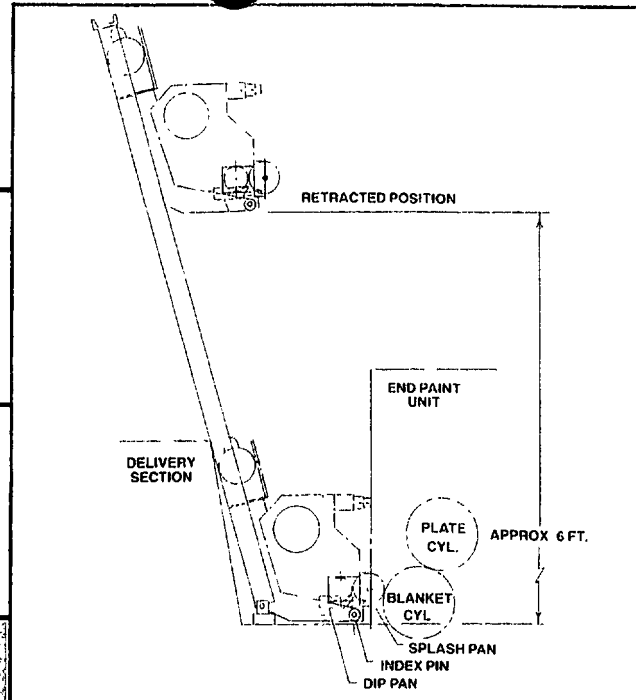
W018901


POMPE HYDRAULIQUE

6

OXY-DRY

Blanket Coater



Applications

This unit is capable of producing high quality results with a wide variety of coating materials including aqueous, U.V., etc.

These coatings provide a wide variety of benefits to your product. For example, high gloss, grease and water resistance, improved rub characteristics. Typically coated products are covers, brochures, packaging, labels and bags.

Operation

The coating unit is positively positioned by interlocking/alignment pins assuring the proper relationship between the press blanket cylinder and the coating unit. The design of this coater provides a quick release mechanism between the rubber & ceramic rolls. This mechanism utilizes positive stops to allow disengagement without the necessity of readjustment when put back in operation. Disengagement is necessary to prevent "flat spots" on the rubber roll when the coater and/or press are shut down.

The ceramic and rubber rolls on the Oxy-Dry Coater are independently driven by controled torque D.C. motors. This drive system provides inherent overload protection to prevent damage to the rolls along with convenient speed control (coating weight control). Once the coater to blanket speed relationship is selected, that ratio remains constent as press speed is changed providing consistent coating throughout the presses speed range.

The coater retraction mechanism is actuated by a heavy duty self locking acme screw which eliminates the need for a locking device which would be necessary for ball screw device. This feature provides the greatest degree of safety and reliability.

The coating handling system offers several unique features to enhance the convenience of operation of this unit. Some of them are as follows:

A The coater uses a "two pan" arrangement. This consists of a dip pan where circulated coating is delivered to the rubber roll. There is a second "dryer" splash pan positioned to catch spray and any foreign matter which could contaminate the coating solution. Both of these pans are removable by hand without the use of tools for clean up purposes.

B The coating material handling system consists of two pumps. The first is utilized to recirculate the coating solution and the second is a drain pump to ensure overflow free circulation. The drain pump can be operated independently to assist in clean-up operations.

C Construction; the design of this unit is consistent with Oxy-Dry's long service life philosophy. Construction is heavy duty with ease of serviceability.

The ceramic coating roll is "pillow block" mounted and the rubber transfer roll is mounted in a slide mechanism. Change over can be accomplished on the press without disassembly of the coater frame and drive mechanism.

Controls

The Oxy-Dry Blanket Coater is interfaced into the press via a programmable controller. This allows adaptability to many different press control systems and ease of changing coater operating sequences.

All electrical components are commercially available high quality items. This provides maximum dependability and economical servicing.

OXY-DRY CORPORATION

2011 Landmeier Road
Elk Grove Village, IL 60007
(312) 593-2030
TWX 910-222-3458
FAX 312-593-0172

217 Highland Parkway
Roselle, NJ 07203
(201) 241-5440 (212) 732-2958
TWX 710-996-5979
FAX 201-241-0280

17972 Sky Park Circle
Suite H
Irvine, CA 92714
(714) 261-1441

Oxy-Dry (UK) Limited
Unit 2, Whitworth Road
Pin Green, Stevenage
Herts SG1 4QS, England
Stevenage (0483) 728881
Telex: 826939

Oxy-Dry Maschinen G.M.B.H.
Bosch-Ring 19
D-6073 Egelsbach
West Germany
(06) 103 4166
Telex: 417920

W018904

OXY-DRY CORPORATION

2011 Landmeier Road, Elk Grove Village, Illinois 60007

Area Code 312/593-2030
312/282-8000

Telex: 910-222-3458

To: Bill Davis

November 20, 1987

Williamson Printing Co.
6700 Denton Drive
Dallas TX 75235

ATTENTION: PRESIDENT

Dear Sir:

Having recently been elected to the Presidency of Oxy-Dry Corporation, succeeding our retiring former President, Jack Pettersen, I've decided to contact a number of our current customers with a special program as a get acquainted offer. Details are given below:

In addition to the attached special offers, I have enclosed a brochure introducing a new product that Oxy-Dry Corporation has been developing for some time now. In our opinion, this is not only extremely well engineered and ruggedly built, but it's a product that eventually every printer must have. It offers speed consistency and efficiency. It's the new Oxy-Dry High Speed Blanket Coater.

I would like to encourage you to read the attached brochure and specifications. I believe it tells the story of WHY. As a matter of fact, if you have any thoughts on this or any of our other fine products, I would appreciate hearing from you. Oxy-Dry has been in business for over 45 years and specifically two words that uniquely describe our internal dedication are: Quality and Integrity.

SPECIAL OFFER: Our Sales Department generated the attached green sheets concept as a thank you gesture for the many years of your support and business. As mentioned above, we'd all very much appreciate your feedback on not only the attached supply items but on any item of related interest.

Thank you again for your continued support over the years.

Sincerely,

OXY-DRY CORPORATION

E.T. McLoughlin

Edward T. McLoughlin
President

ETM/rmo

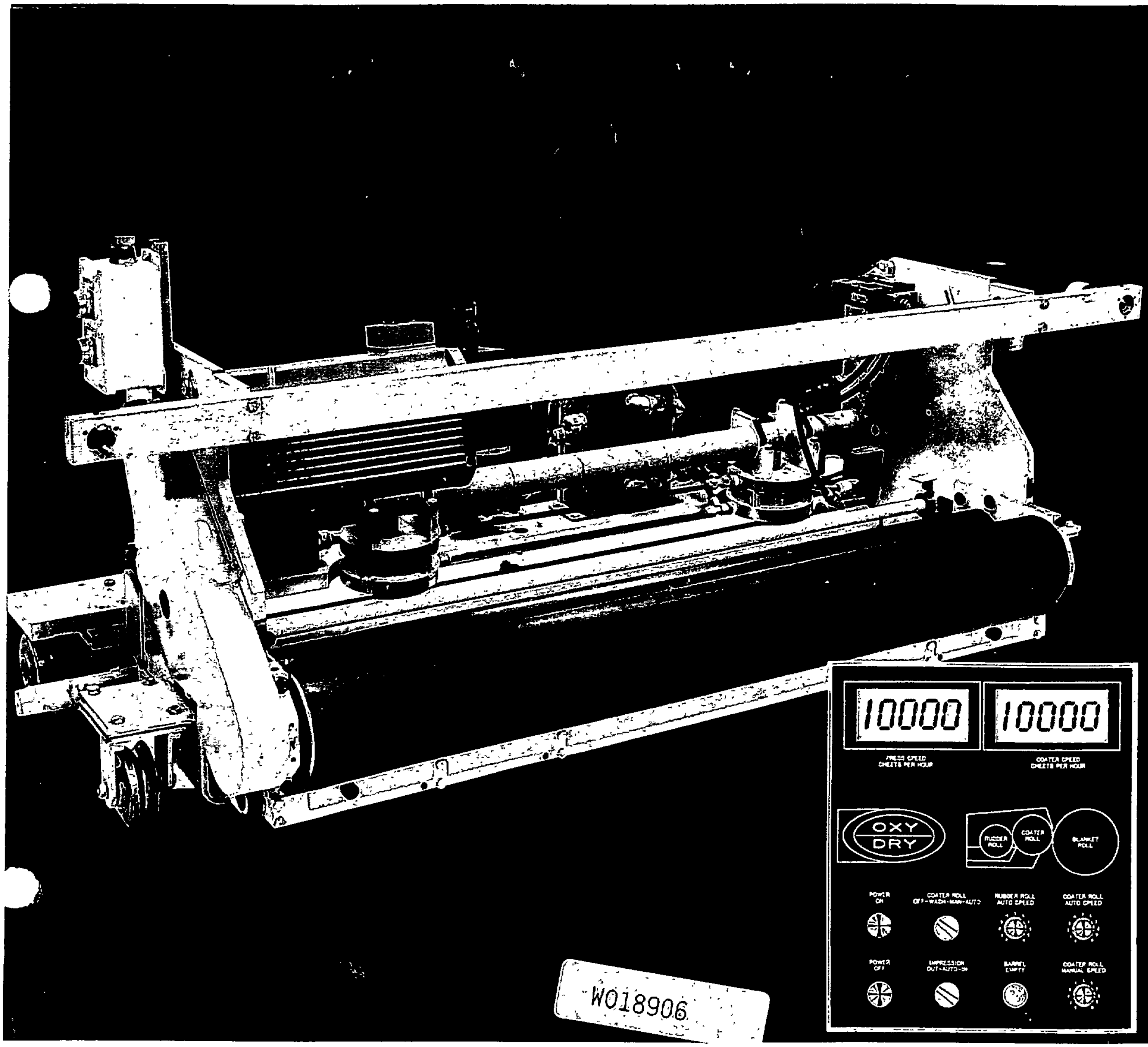
Enclosures

W018905

The very best way to apply coating is with an

OXY-DRY COATER

Now your printing can be worth more, much more



Coating makes a big difference

and here's why:

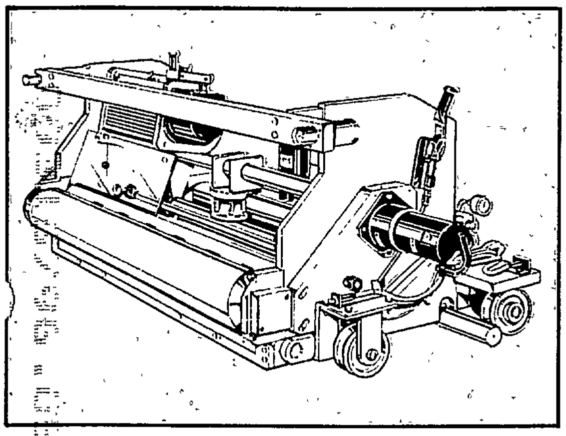
This Oxy-Dry Coater specification sheet has been printed with coating. Feel it and then objectively contemplate the comparisons. . . it gives an everlasting focus of quality to the printed piece. It makes your printing worth more. . much more, because it's magnificently different and will give you a leg up on the competition. The new Oxy-Dry Coater has been engineered to readily fit most presses. It is ruggedly constructed and simple to install and operate. The Oxy-Dry Coater saves time and assures a smooth uniform application of aqueous coating. In addition, it reduces the use of offset powders. Quality coating generates high gloss, improved rub resistance, regulated surface slip and controlled variations in luster.

Oxy-Dry invented and pioneered the Electrostatic Sprayer to prevent offset and developed the powder formulas to go along with the electrostatic sprayers as well. Oxy-Dry in almost 50 years of serving the printing industry with revolutionary new products such as the Blanket Washers, Ink Agitators, Ink Levelers, Sheeters, Stackers, Color-to-Color Systems, Cut-off Controls, Web Breaks and Web Guides, has also brought to market a Dryer that provides the right drying acceleration. Oxy-Dry is proud to engineer another much needed and valued accessory to the printing press. The Oxy-Dry Coater now adds a truly new dimension to printing.

COMPARISON OF COATINGS

COATING	AQUEOUS	U.V.	PRESS VARNISH
Gloss	Good/Excellent	Excellent	Fair
Rub	Good/Excellent	Excellent	Fair
Glue Applications	Excellent	Fair	Poor
Thickness Control	Excellent	Good	Fair
Finger Prints	Excellent	Poor	Fair
EPA Safety Reference	Excellent	Poor	Good
Coating Costs	Economical	Expensive	Economical

The Oxy-Dry System



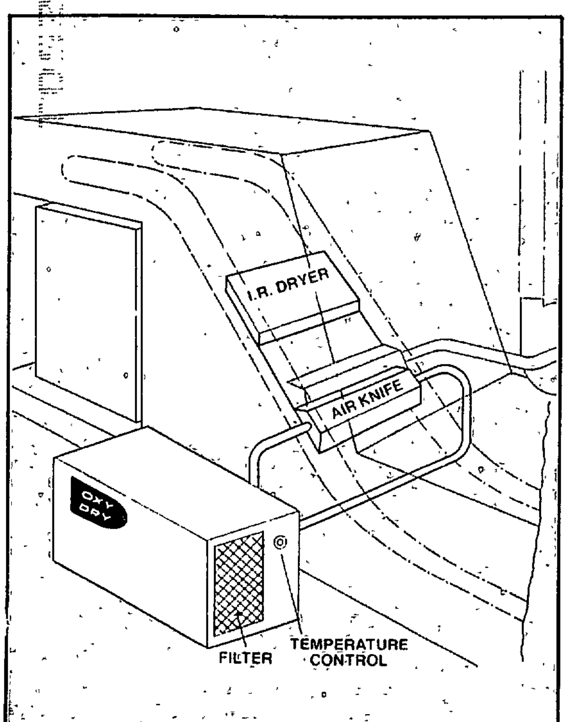
Oxy-Dry Coater Facts

1 **Control of Coating:** The Oxy-Dry Coater allows a wide range of coating thickness and infinite control with just a turn of a dial on the control panel.

2 **Simplicity of Operation:** The Oxy-Dry Coater is designed to return to a pre-set position each time the coater is used, no costly makeready adjustment.

3 **Ease of Maintenance:** The Oxy-Dry Coating System provides easy access to rollers and recirculating system. Makeready and Washup will take approximately 15 minutes.

4 **Spot Coating:** The Oxy-Dry Coater's unique micrometer adjustment allows spot coating by simply cutting packing under the blanket.



Oxy-Dry Medium Wave Infrared Dryer

The main advantages of the Oxy-Dry Infrared Dryer are:

- Variable/Medium wave length radiation with high intensity output
- Quick response
- Significant energy savings
- Simplicity of operation

To achieve an optimum of infrared radiation high intensity output it is necessary to heat the substrate within the minimum distance of sheet travel. A quick response is also essential—in that an instantaneous heat up and cool down is required when the press comes on or off impression. The Oxy-Dry "tubeless" dryer is most unique in these two features—high intensity output coupled with quick response.

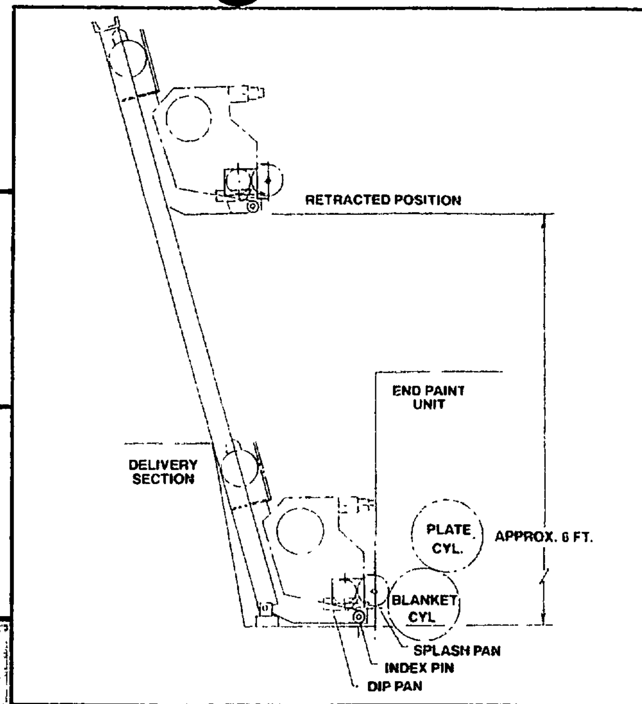
Oxy-Dry Air Knife

The Oxy-Dry Heated Air Knife was designed specifically to compliment the Oxy-Dry Blanket Coater. It will provide two "curtains" of air across the sheet (or web) at velocity up to 4600 ft. per minute. The air is heated by a high efficiency electric heater which can provide temperatures from ambient to 200°F

W018908

OXY-DRY

Blanket Coater



Applications

This unit is capable of producing high quality results with a wide variety of coating materials including aqueous, U.V., etc.

These coatings provide a wide variety of benefits to your product. For example, high gloss, grease and water resistance, improved rub characteristics. Typically coated products are covers, brochures, packaging, labels and bags.

Operation

The coating unit is positively positioned by interlocking/alignment pins assuring the proper relationship between the press blanket cylinder and the coating unit. The design of this coater provides a quick release mechanism between the rubber & ceramic rolls. This mechanism utilizes positive stops to allow disengagement without the necessity of readjustment when put back in operation. Disengagement is necessary to prevent "flat spots" on the rubber roll when the coater and/or press are shut down.

The ceramic and rubber rolls on the Oxy-Dry Coater are independently driven by controled torque D.C. motors. This drive system provides inherent overload protection to prevent damage to the rolls along with convenient speed control (coating weight control). Once the coater to blanket speed relationship is selected, that ratio remains constent as press speed is changed providing consistent coating throughout the presses speed range.

The coater retraction mechanism is actuated by a heavy duty self locking acme screw which eliminates the need for a locking device which would be necessary for ball screw device. This feature provides the greatest degree of safety and reliability.

The coating handling system offers several unique features to enhance the convenience of operation of this unit. Some of them are as follows.

A The coater uses a "two pan" arrangement. This consists of a dip pan where circulated coating is delivered to the rubber roll. There is a second "dryer" splash pan positioned to catch spray and any foreign matter which could contaminate the coating solution. Both of these pans are removable by hand without the use of tools for clean up purposes.

B The coating material handling system consists of two pumps. The first is utilized to recirculate the coating solution and the second is a drain pump to ensure overflow free circulation. The drain pump can be operated independently to assist in clean-up operations.

C Construction, the design of this unit is consistent with Oxy-Dry's long service life philosophy. Construction is heavy duty with ease of serviceability.

The ceramic coating roll is "pillow block" mounted and the rubber transfer roll is mounted in a slide mechanism. Change over can be accomplished on the press without disassembly of the coater frame and drive mechanism.

Controls

The Oxy-Dry Blanket Coater is interfaced into the press via a programmable controller. This allows adaptability to many different press control systems and ease of changing coater operating sequences.

All electrical components are commercially available high quality items. This provides maximum dependability and economical servicing.

OXY DRY ®

OXY-DRY CORPORATION

2011 Landmeier Road
Elk Grove Village, IL 60007
(312) 593-2030
TWX 910-222-3458
FAX 312-593-0172

217 Highland Parkway
Roselle, NJ 07203
(201) 241-5440 (212) 732-2958
TWX 710-996-5979
FAX 201-241-0280

17972 Sky Park Circle
Suite H
Irvine, CA 92714
(714) 261-1441

Oxy-Dry (UK) Limited
Unit 2, Whitworth Road
Pin Green, Stevenage
Herts SG1 4QS, England
Stevenage (0483) 728881
Telex: 826939

Oxy-Dry Maschinen G.M.B.H.
Bosch-Ring 19
D-6073 Egelsbach
West Germany
(06) 103 4166
Telex: 417920

W018908.1

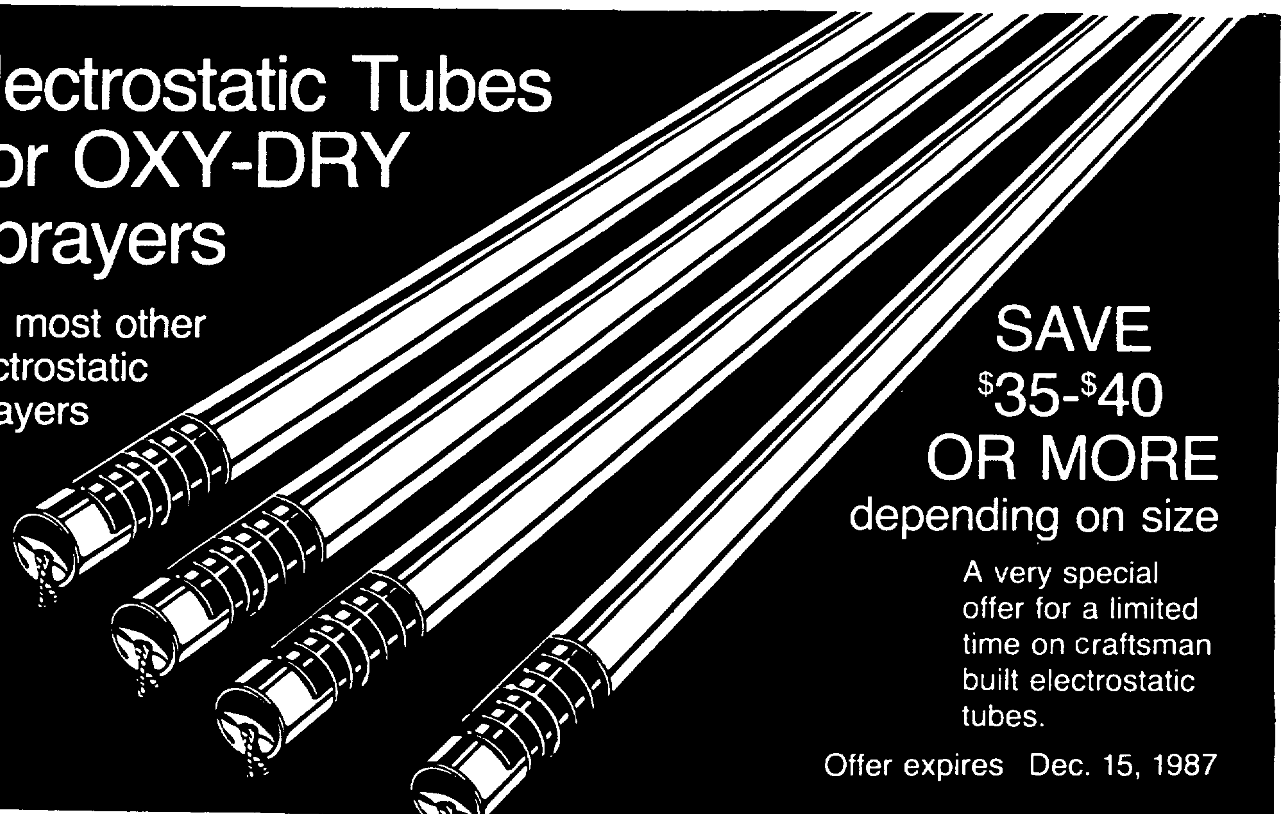
Best Buy Ever!

OXY DRY®

BUY 3 NOW
GET THE 4TH FREE!

Electrostatic Tubes For OXY-DRY Sprayers

Fits most other electrostatic sprayers



SAVE $35-$40 OR MORE depending on size

A very special offer for a limited time on craftsman built electrostatic tubes.

Offer expires Dec. 15, 1987

Take advantage of this special offer by returning this coupon today.

We've never made an offer like this before. It is an unusual offer that saves you more . . . much more.

Your order No. ____________

Make of press ____________

Tube size—length ____________

(Please print)
Ship To: ____________

Company Name ____________

Address ____________

City ____________ State ________ Zip ________

____________ Authorized Signature

____________ Date

Send coupon to OXY-DRY Corporation, 2011 Landmeier Road, Elk Grove Village, IL 60007

W018909

Brand New from OXY DRY®

The very best way to prevent offset is with OXY-DRY Powders

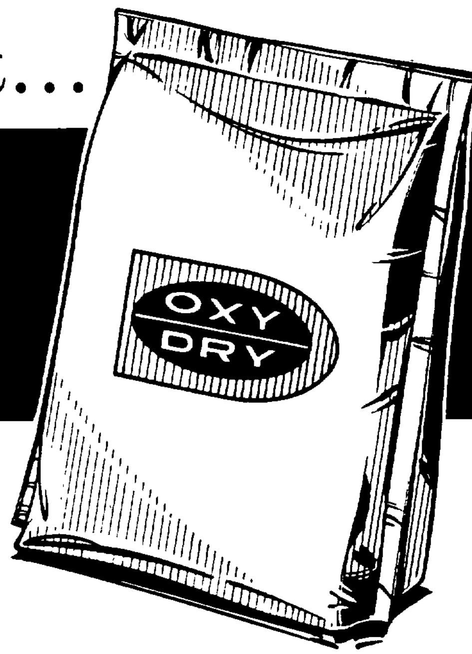
OXY-DRY POWDERS

IN A NEW 2-LB. SINGLE SERVING POUCH

Test it–you'll like it...

FREE

SAMPLE POUCH



IDEAL SIZE FOR EASY HANDLING

We'll send you your 2-lb. pouch just for answering these few questions.

Our pouch approach is brand new. We believe it will make loading a sprayer neater, easier and cleaner. The new OXY-DRY Pouch can be purchased with 5 to a carton.

The Pouch Powder is OXY-DRY Powder 744, micron size 27.

For other OXY-DRY powders refer to the OXY-DRY Powders specification sheet.

Offer expires Dec. 15, 1987

---

① What powders are you presently using?

____

____

② What micron size powder do you use?

____

③ Press(es) you presently use?

____

____

④ Type of printing you perform?

____

____

⑤ Do you use an OXY-DRY Sprayer or other brand?

Please specify ____________________

____

(Please print)

Ship To: ____________________

Company Name ____________________

Address ____________________

City __________ State __________ Zip __________

____________________ __________

Authorized Signature Date

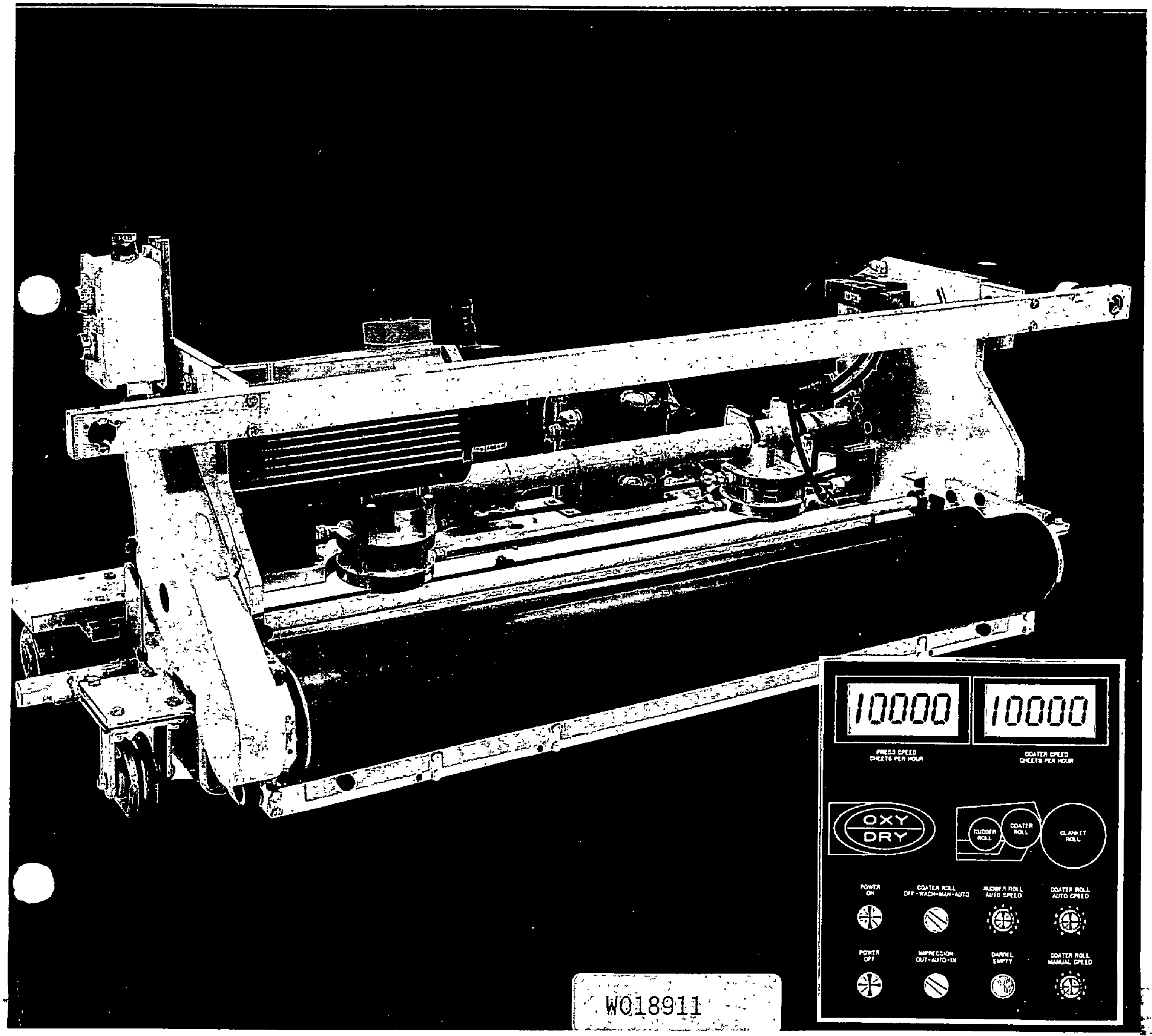
Send to: **OXY-DRY CORPORATION**
2011 Landmeier Road
Elk Grove Village, IL 60007

W018910

The very best way to apply coating is with an

OXY-DRY COATER

Now your printing can be worth more, much more



Coating makes a big difference

and here's why:

This Oxy-Dry Coater specification sheet has been printed with coating. Feel it and then objectively contemplate the comparisons . . . it gives an everlasting focus of quality to the printed piece. It makes your printing worth more . . much more, because it's magnificently different and will give you a leg up on the competition. The new Oxy-Dry Coater has been engineered to readily fit most presses. It is ruggedly constructed and simple to install and operate. The Oxy-Dry Coater saves time and assures a smooth uniform application of aqueous coating. In addition, it reduces the use of offset powders. Quality coating generates high gloss, improved rub resistance, regulated surface slip and controlled variations in luster.

Oxy-Dry invented and pioneered the Electrostatic Sprayer to prevent offset and developed the powder formulas to go along with the electrostatic sprayers as well. Oxy-Dry in almost 50 years of serving the printing industry with revolutionary new products such as the Blanket Washers, Ink Agitators, Ink Levelers, Sheeters, Stackers, Color-to-Color Systems, Cut-off Controls, Web Breaks and Web Guides, has also brought to market a Dryer that provides the right drying acceleration. Oxy-Dry is proud to engineer another much needed and valued accessory to the printing press. The Oxy-Dry Coater now adds a truly new dimension to printing.

COMPARISON OF COATINGS

COATING	AQUEOUS	U.V.	PRESS VARNISH
Gloss	Good/Excellent	Excellent	Fair
Rub	Good/Excellent	Excellent	Fair
Glue Applications	Excellent	Fair	Poor
Thickness Control	Excellent	Good	Fair
Finger Prints	Excellent	Poor	Fair
EPA Safety Reference	Excellent	Poor	Good
Coating Costs	Economical	Expensive	Economical

OXY DRY

OXY-DRY CORPORATION

2011 Landmeier Road, Elk Grove Village, Illinois 60007

Area Code 312/593-2030
312/282-8000

Telex: 910-222-3458

OXY-DRY HIGH SPEED BLANKET COATER

APPLICATIONS

This unit is capable of producing a high quality product with a durable finish while utilizing a wide variety of coating materials to include the aqueous, U.V., or related coating materials.

These coatings can provide a variety of benefits to your printed products. For example: high gloss, increased grease and water resistance and improved rub characteristics. Typically coated products are covers, brochures, packaging labels and bags.

OPERATION

The coating unit is positively positioned by interlocking/alignment pins assuring the proper relationship between the press blanket cylinder and the coating unit. The design of this coater provides a quick release mechanism between the rubber and ceramic rolls. This mechanism utilizes positive stops to allow disengagement without the necessity for readjustment when put back in operation. Disengagement is necessary to prevent "flat spots" on the rubber roll when the coater and/or press are shut down.

Touque controlled rolls on the Oxy-Dry Coater are independently driven by controller torque D.C. motors. This drive system provide inherent overload protection to prevent damage to the rolls along with convenient speed control. Once the coater to blanket speed relationship is selected, that ratio remains constant as press speed changes. This provides consistent coating throughout the press speed range.

As the coater retraction mechanism is actuated, heavy duty self-locking acme screws eliminate the need for a locking device which would normally be used in ball screw mechanisms. This feature provides the greatest degree of safety and reliability for the end user.

1. The coater uses a "two pan" arrangement. This consists of a dip pan where circulated coating is delivered to the rubber roll. There is a second "dry" drip pan position to catch spray and any foreign matter which could contaminate the coating solution. Both of these pans are removable by hand without the use of tools for clean-up purposes.

W018913

OXY-DRY HIGH SPEED BLANKET COATER

OPERATION (continued)

2. The coating material handling system consists of two pumps. The first is utilized to recirculate the coating solution and the second is a drain pump to ensure overflow free circulation. The drain pump can be operated independently to assist in clean-up operations.

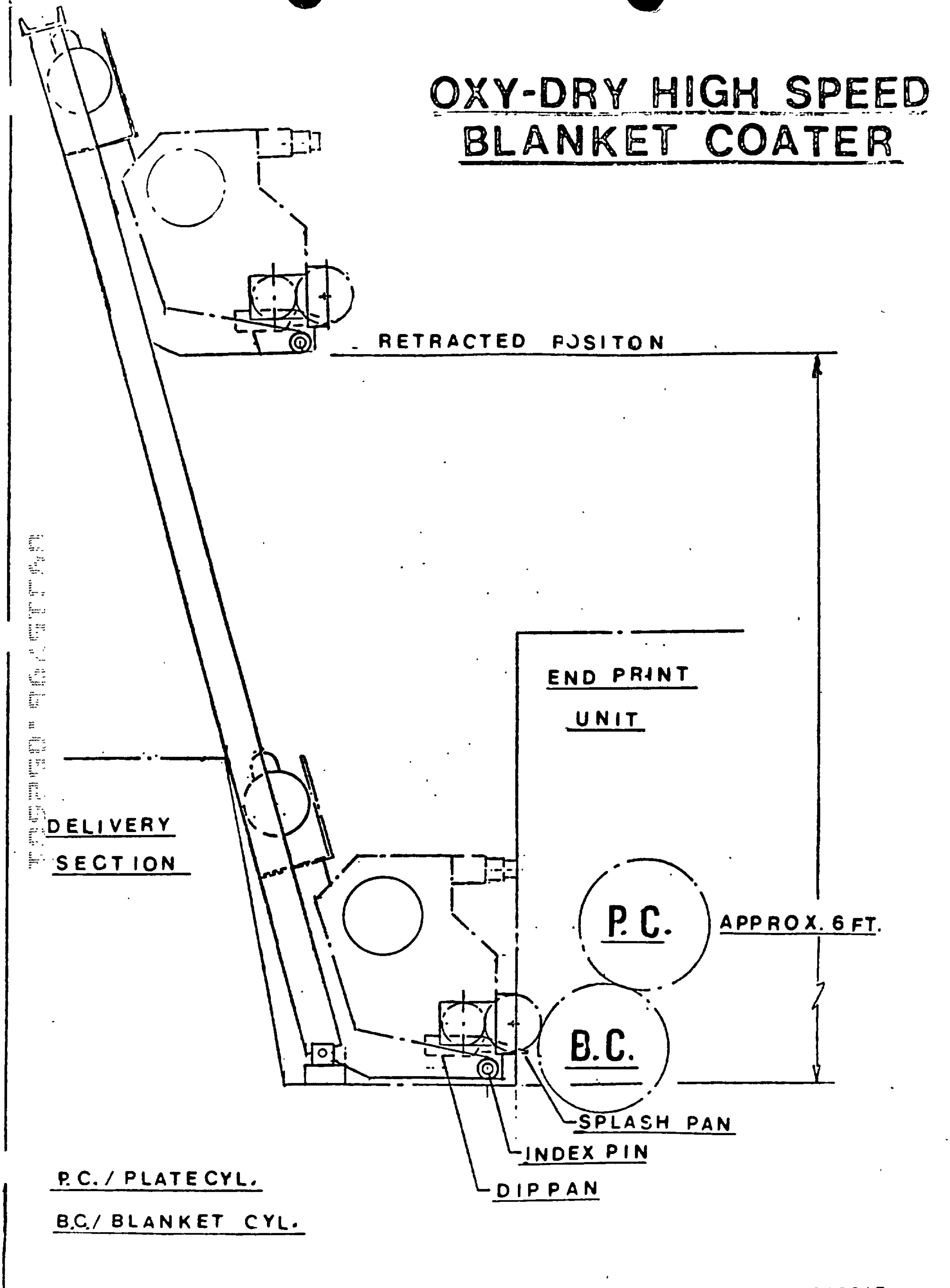
3. Construction - The design of this unit is consistent with Oxy-Dry's long service life philosopy. Construction is heavy duty with ease of serviceability.

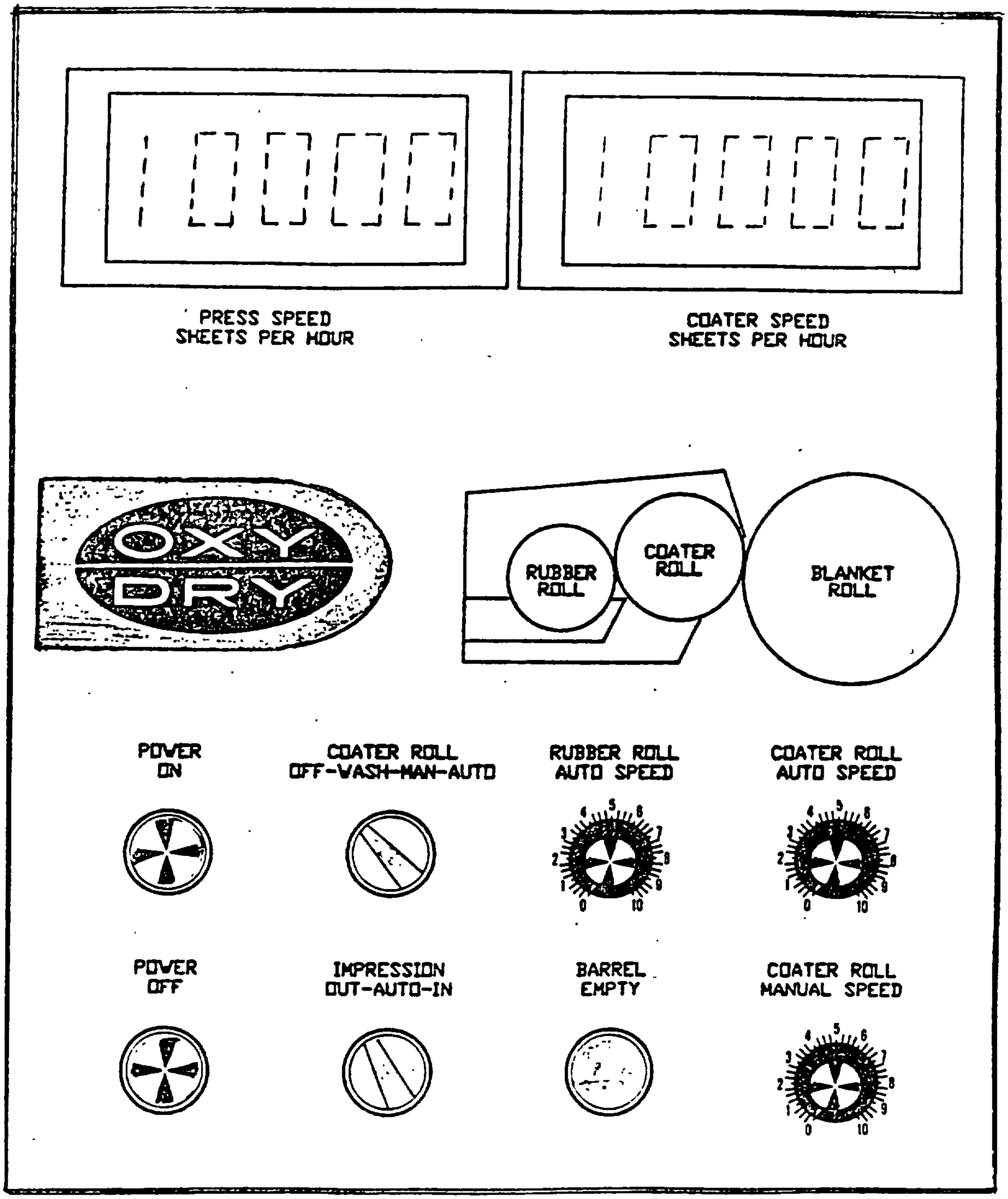
CONTROLS

The Oxy-Dry Blanket Coater is interfaced into the press with a programmable controller. This allows adaptability to many different press control systems and ease of changing coater operating sequences.

All electrical components are commercially available high quality items. This provides maximum dependable and economical servicing.

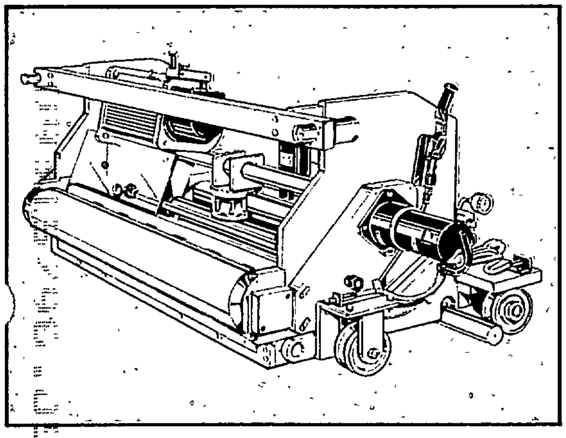
OXY-DRY HIGH SPEED BLANKET COATER





OXY-DRY HIGH SPEED
BLANKET COATER

The Oxy-Dry System



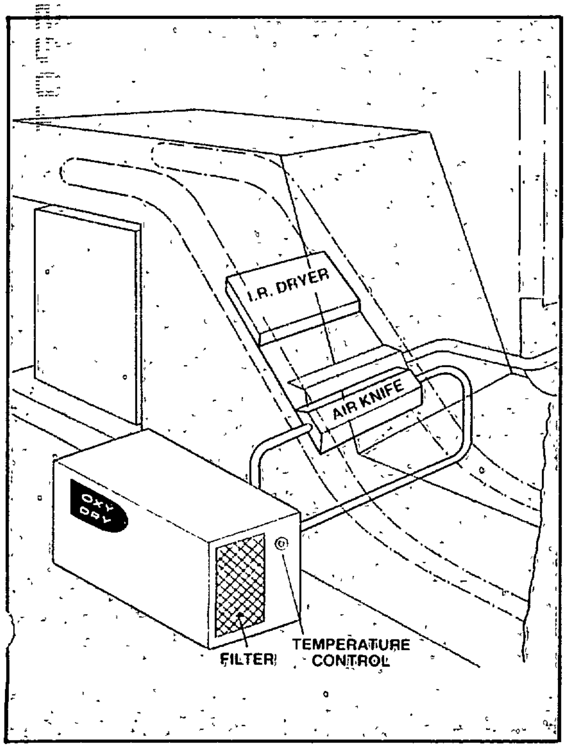
Oxy-Dry Coater Facts

1 **Control of Coating:** The Oxy-Dry Coater allows a wide range of coating thickness and infinite control with just a turn of a dial on the control panel.

2 **Simplicity of Operation:** The Oxy-Dry Coater is designed to return to a pre-set position each time the coater is used, no costly makeready adjustment.

3 **Ease of Maintenance:** The Oxy-Dry Coating System provides easy access to rollers and recirculating system. Makeready and Washup will take approximately 15 minutes.

4 **Spot Coating:** The Oxy-Dry Coater's unique micrometer adjustment allows spot coating by simply cutting packing under the blanket.



Oxy-Dry Medium Wave Infrared Dryer

The main advantages of the Oxy-Dry Infrared Dryer are:

- Variable/Medium wave length radiation with high intensity output
- Quick response
- Significant energy savings
- Simplicity of operation

To achieve an optimum of infrared radiation high intensity output it is necessary to heat the substrate within the minimum distance of sheet travel. A quick response is also essential—in that an instantaneous heat up and cool down is required when the press comes on or off impression. The Oxy-Dry "tubeless" dryer is most unique in these two features—high intensity output coupled with quick response

Oxy-Dry Air Knife

The Oxy-Dry Heated Air Knife was designed specifically to compliment the Oxy-Dry Blanket Coater. It will provide two "curtains" of air across the sheet (or web) at velocity up to 4600 ft. per minute. The air is heated by a high efficiency electric heater which can provide temperatures from ambient to 200°F.

W018917

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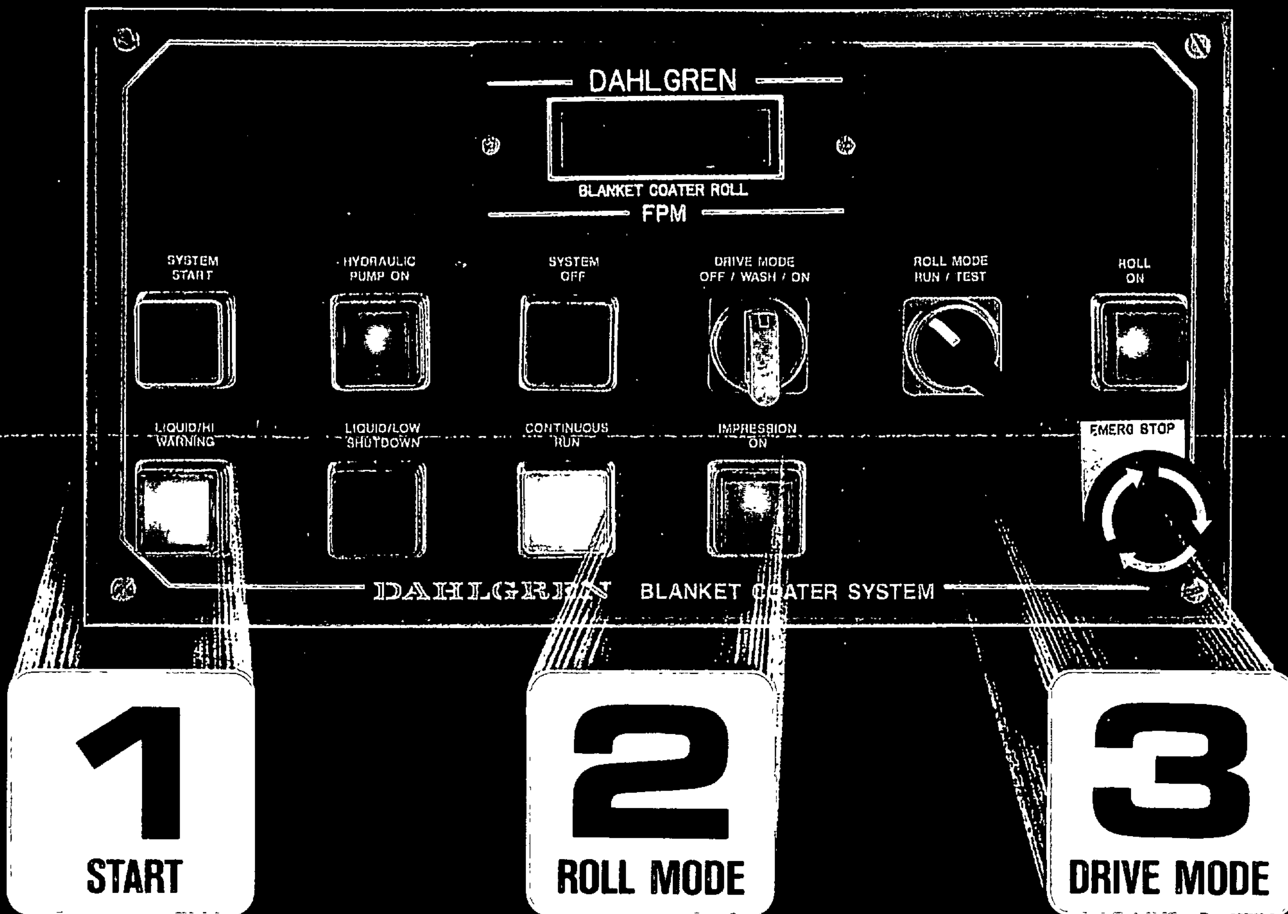
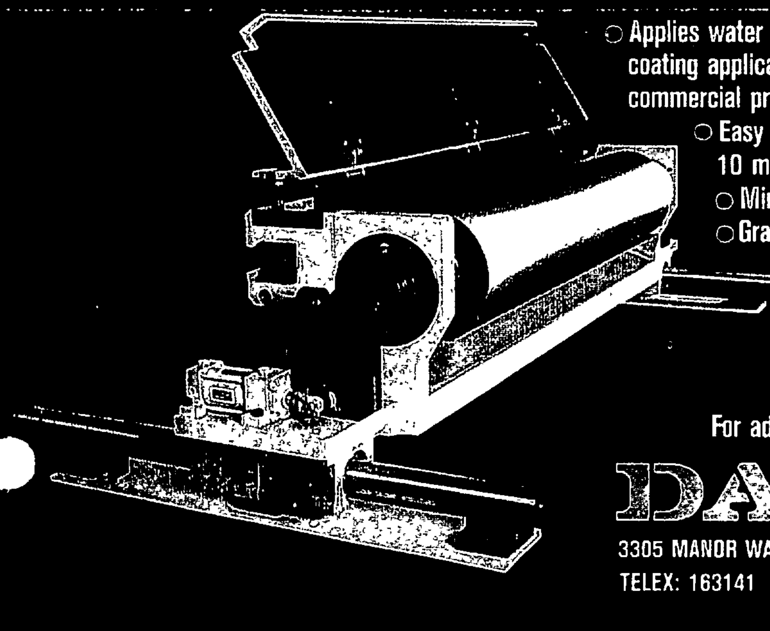
The best Coater on the market is also the easiest to operate — as simple as...



As is always the case — the best solution to a problem is the simplest. Dahlgren's 20 years of experience in building Coaters has resulted in the most popular Coater on the market.



The reasons are simple...Dahlgren's single roll Coater:

- Applies water base, U.V. and heat seal coatings for a broad range of coating applications — including blister packaging, labels, cartons and commercial printing.
- Applies overall or exact pattern coatings.
- Easy to operate — 5 minutes maximum makeready; 10 minutes cleanup.
- Strong durable construction.
- Minimum maintenance due to fewer parts.
- Gravure roll hydraulically locks to blanket — eliminates chattering and slinging.
- Available for all popular sheet fed presses.
- The most competitively priced on the market.

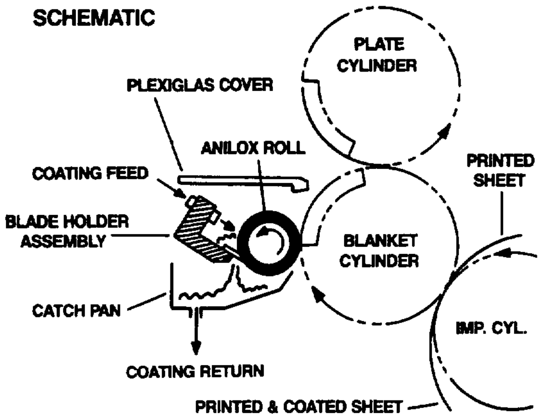
For additional information contact:

DAHLGREN

3305 MANOR WAY DALLAS, TEXAS 75235 214/357-4621 1-800/527-5301
TELEX: 163141

Product Data DAHLGREN BLANKET COATER

SCHEMATIC



SCHEMATIC DESCRIPTION:

Coating is accomplished with a single gravure roll in pressure contact with an offset press blanket. Coating on the blanket is then applied to the previously wet (or dry) printed sheet. Enroute to the delivery, the sheet is dried with Dahlgren heating lamps and forced air.

A uniform quantity of coating is continuously offered to the press. While the blade removes excess coating from the surface of the roll, engraved cells (voids) on the surface, carry a pre-selected precise volume of coating to the blanket. Coating removed from the cells by the blanket is replenished upon rotation to a flooded-nip at the blade/roll interface. (Coating not removed by the blanket is re-wetted at this nip.) Accumulation, starvation, roll run-out, streaks, etc., are non-existent. The roll is positively driven in both "On" and "Off" positions. Fresh coating is continuously circulated through the coater.

STANDARD FEATURES:

- Rugged, unitized construction for bolt-on adaptation to press frames.
- Horizontal actuation and quick-release retraction from press blanket to remote area of last press unit.

APPLICATOR ROLL ASSEMBLY:

- Heavy wall steel tubing.
- Precision engraved surface (copper, nickel and chrome plated).
- Statically and dynamically balanced.
- Pre-selected volume carrying capacity meeting specific customer coat weight requirements.
- Hydraulically driven at press speed.
- Mounted in heavy-duty, oversized, anti-friction bearings.
- Accurately positioned and hydraulically locked against press mounted "ON" stops.

OTHER FEATURES:

- Rugged blade holder.
- Adjustable pressure capability of blade to coater roll with "Max" pressure limiting stops.
- Flexible, replaceable, "blue-steel", hardened and tempered doctor blade.
- Fixed-angle "wiping" design for doctor blade.
- Coating catch pan under blade holder and coating roll.
- Hinged, clear plexiglas cover over blade holder assembly and coating roll. Serves as bench when cleaning or changing blanket.
- Hydraulic power unit, pre-plumbed and tested with 20 gallon reservoir and 5 H.P. TEFC motor and fixed displacement pump. Flow-control valves for hydraulic motor and actuation cylinders.
- Electrical probes sensing coating flow and level (at coater inlet and in catch pan).
- Operator control station with enclosure and operator devices, with digital "FPM" readout.
- "NEMA 12" power control cabinet with control circuit isolation transformer.

CIRCULATION SYSTEM:

- Feed and return, constant displacement pump.
- Variable speed air-motor drive to pump.
- Positive drain and return of coating to drum.
- Quick-disconnects at coater head, catch pan and supply drum.
- Quick-disconnects for customer furnished wash-up lines.
- 3/4" I.D. flexible, vinyl tubing.

OPTIONAL EQUIPMENT:

- Custom designed coater retraction systems.
- Custom designed coating circulation systems.

ELECTRICAL/PNEUMATIC INPUT REQUIREMENTS:

Standard: 230 VAC ± 10%, 3-phase, 60 Hz, 25 Amps (10 KVA) Load

Optional: 460 VAC ± 5%, 3-phase, 60 Hz, 15 Amps (12 KVA) Load
380 VAC ± 5%, 3-phase, 50 Hz, 15 Amps, (10 KVA) Load

SHEET-FED PRESSES DESIGNED FOR:

AURELIA	HARRIS	MARINONI	O.M.C.S.A.
BOBST	HEIDELBERG	MIEHLE	PLANETA (ROYAL ZENITH)
COLOR METAL	KOMORI	MILLER	SOLNA
CRABTREE	M.A.N.	MITSUBISHI	OTHERS
HALM	MANN	NEBIOLO	

WARRANTY SERVICE:

- Installation and start-up supervision
- 6 months gravure roll warranty
- 90 day service warranty
- 12 months — other parts warranty

PATENTS PENDING

DAHLGREN

DAHLGREN U.S.A., P.O. BOX 36305, DALLAS, TEXAS 75235
TEL: (214) 630-3234, WATS: 800-527-5301, TLX: 163141

W018920

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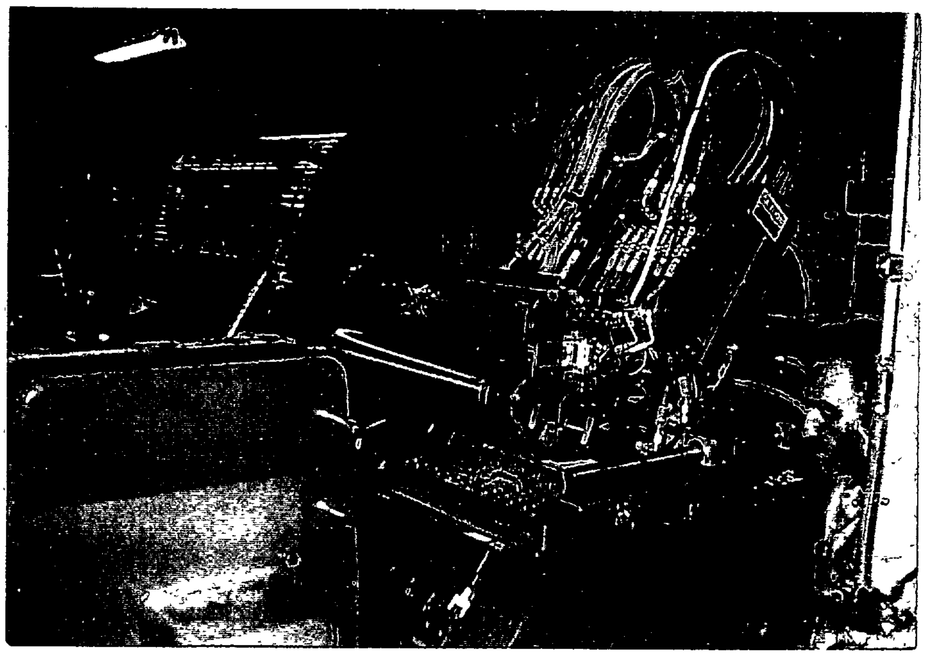
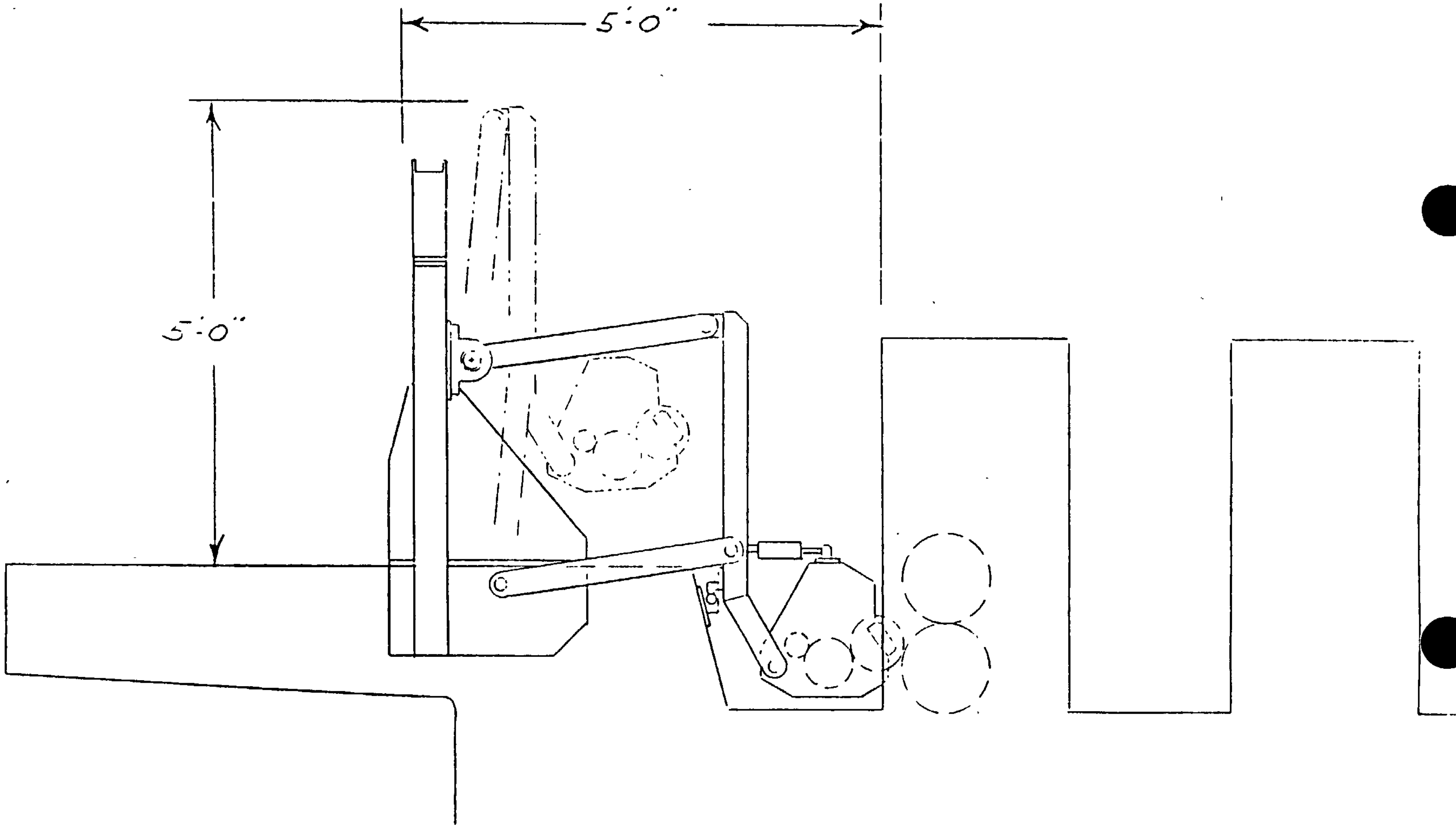


PRESS	REMOVAL SYSTEM	RAPIDAC BLANKET COATER MODEL NO.	SPARE ROLLS PART NOS. APPLICATOR	PICKUP	METERING
Miller 41"	Yes	A-2002	D-2000-1-1	D-2000-2-1	D-2000-3-1
Heidelberg 40"	Yes	A-2003	D-2000-1-2	D-2000-2-2	D-2000-3-2
Komori 40"	Yes	A-2006	D-2000-1-2	D-2000-2-2	D-2000-3-2
Planeta 40"	Yes	A-2009	D-2000-1-2	D-2000-2-2	D-2000-3-2
Planeta 50"	Yes	A-2012	D-2022-1-4	D-2022-2-4	D-2022-3-4
Planeta 55"	Yes	A-2015	D-2022-1-3	D-2022-2-3	D-2022-3-3
Planeta 64"	Yes	A-2018	D-2022-1-2	D-2022-2-2	D-2022-3-2
Miehle 60"	Yes	A-2021	D-2022-1-1	D-2022-2-1	D-2022-3-1
Harris 60"	Yes	A-2024	D-2022-1-1	D-2022-2-1	D-2022-3-1
Harris 60"	Yes	A-2028	D-2022-1-1	D-2022-2-1	D-2022-3-1
Harris 60"	Yes	A-2029	D-2022-1-1	D-2022-2-1	D-2022-3-1
Planeta 50"	No	A-2031	D-2032-1-1	D-2032-2-1	D-2032-3-1
Planeta 55"	No	A-2033	D-2032-1-2	D-2032-2-2	D-2032-3-2
Planeta 64"	No	A-2035	D-2032-1-3	D-2032-2-3	D-2032-3-3
Harris 60"	No	A-2037	D-2032-1-4	D-2032-2-4	D-2032-3-4
Crabtree 50.5"	No	A-2039	D-2040-1-1	D-2040-2-1	D-2040-3-1

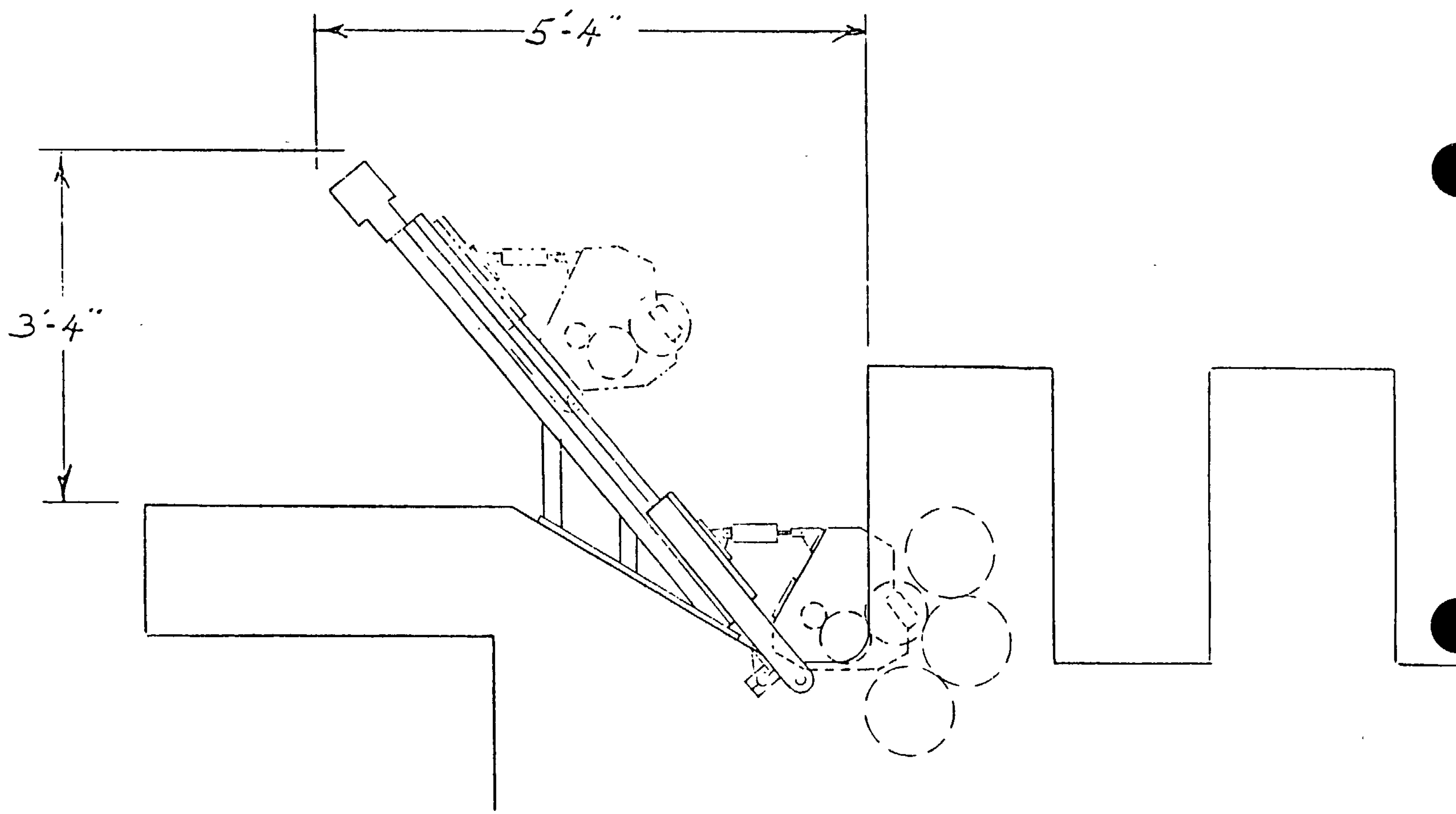


PRESS

MILLER 41"

RAPIDAC BLANKET COATER

MODEL NO. A-2002

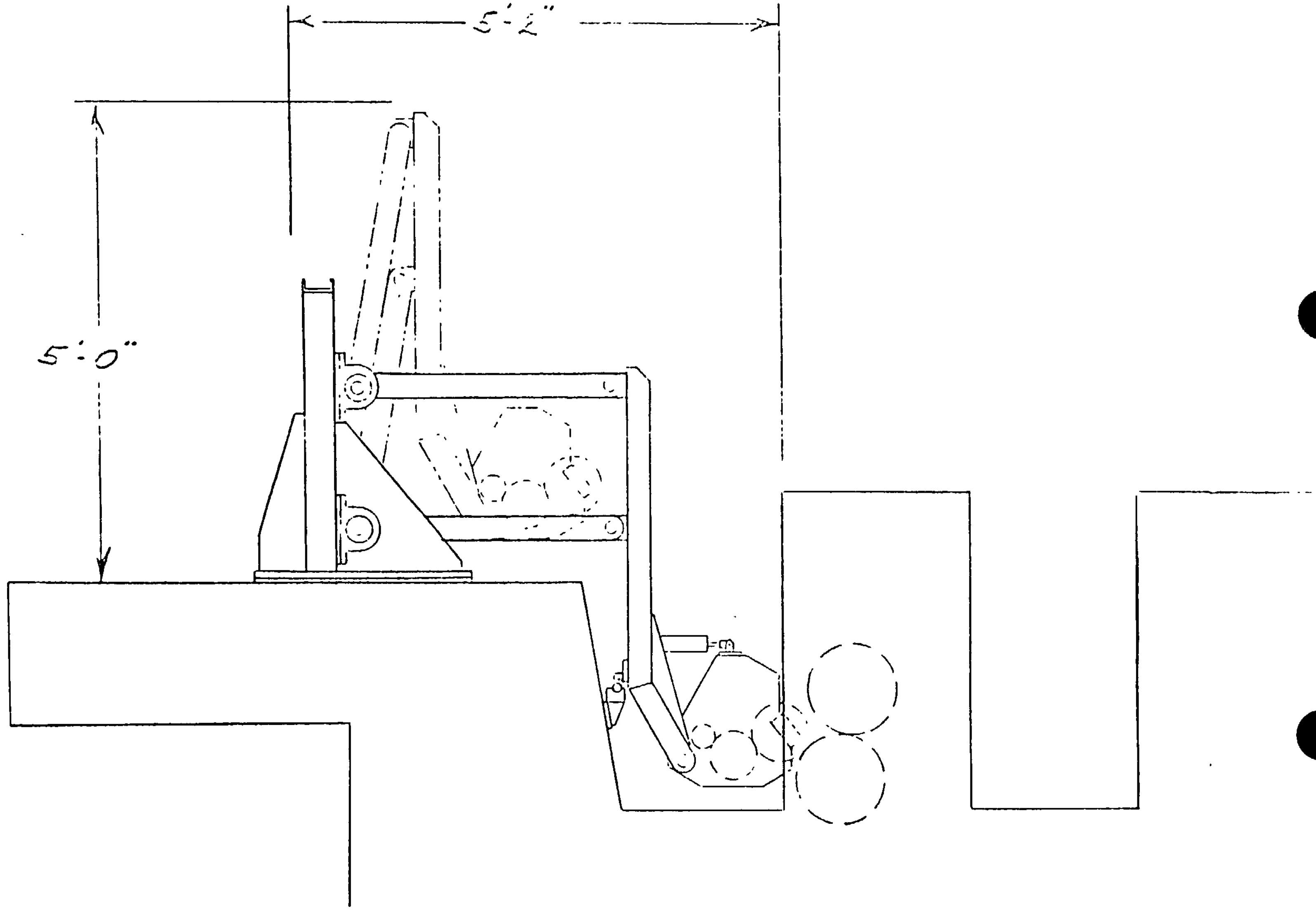


PRESS

HEIDELBERG 40"

RAPIDAC BLANKET COATER

MODEL NO. A-2003



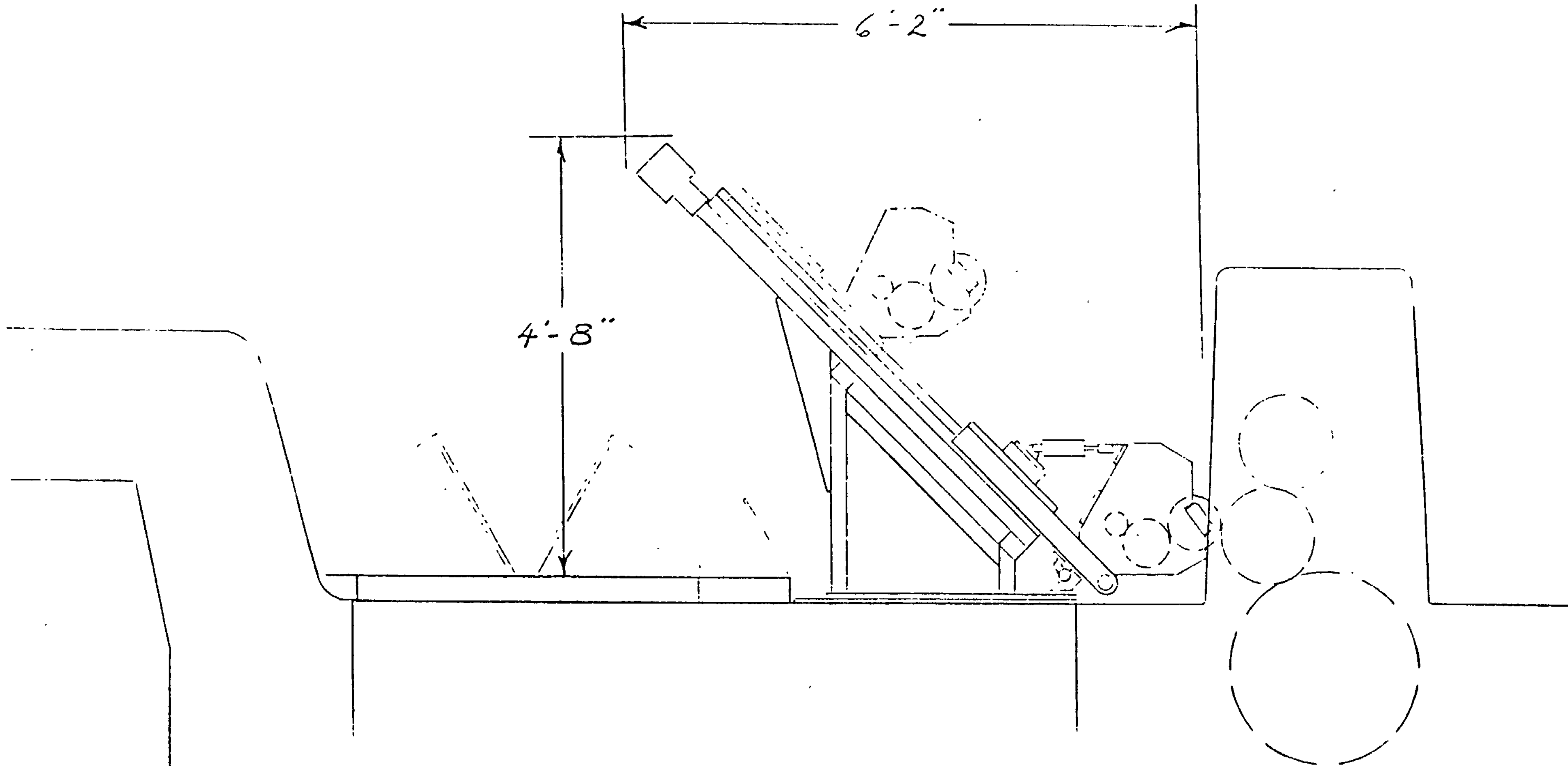
PRESS

KOMORI 40"

RAPIDAC BLANKET COATER

MODEL NO. A-2006

W018926

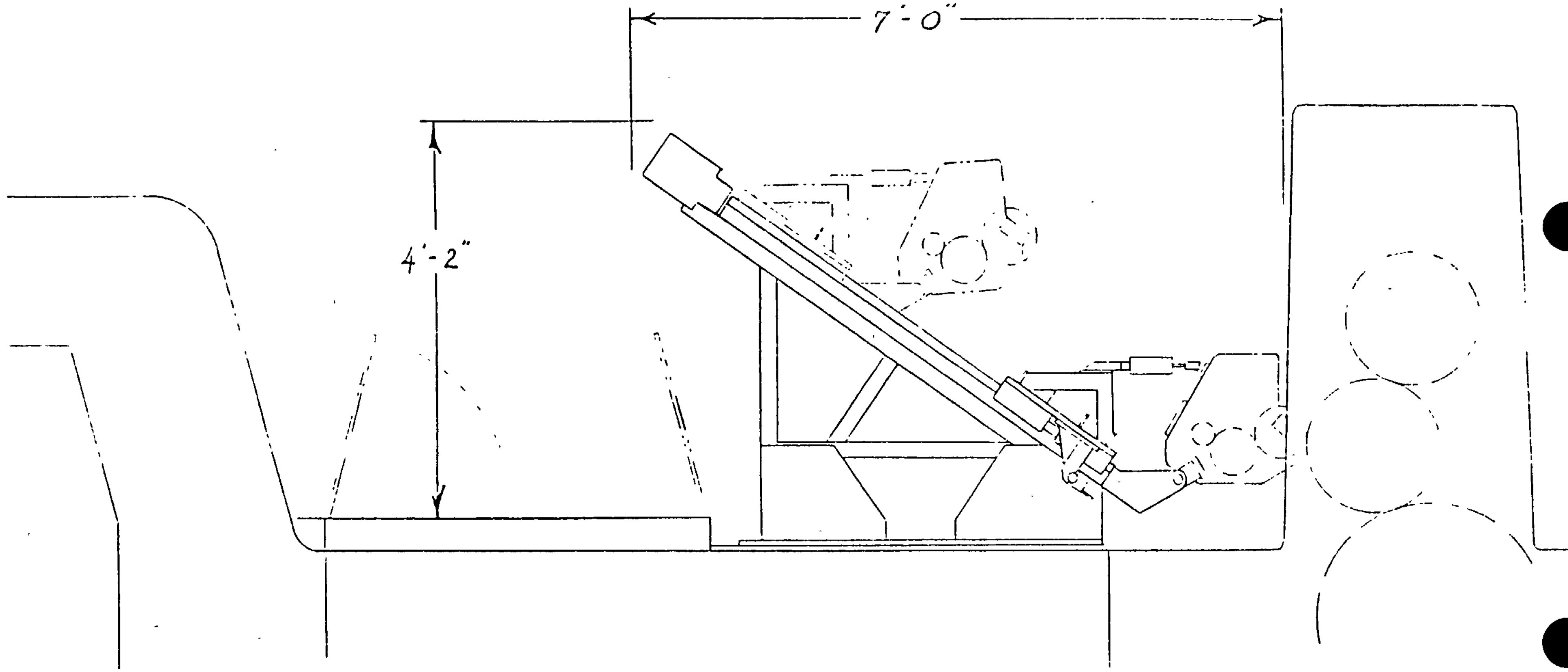


PRESS

PLANETA 40"
WITH EXTENDED DELIVERY

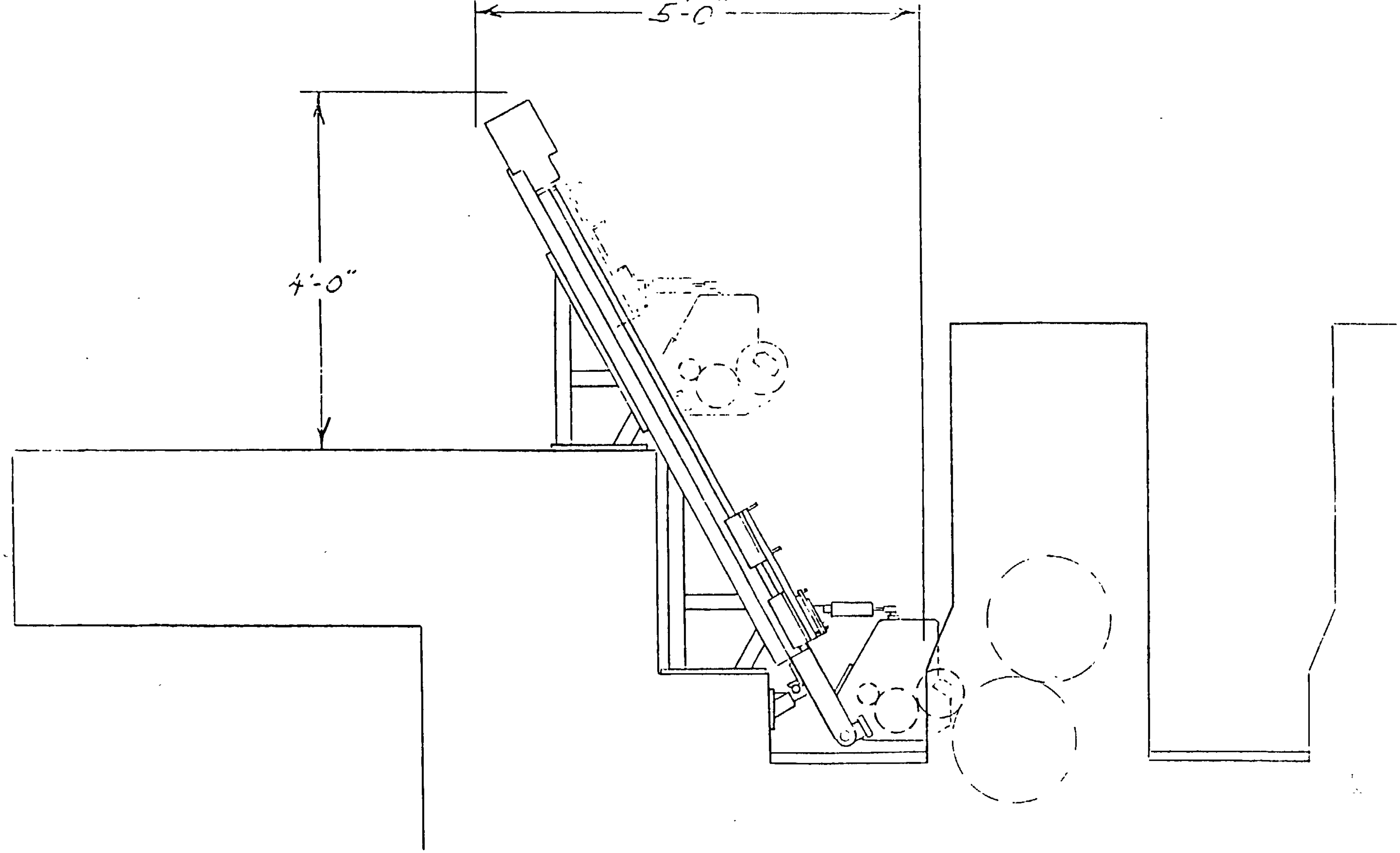
RAPIDAC BLANKET COATER

MODEL NO. A-2009



PRESS	RAPIDAC BLANKET COATER
PLANETA 50" WITH EXTENDED DELIVERY	MODEL NO. A-2012
PLANETA 55" WITH EXTENDED DELIVERY	MODEL NO. A-2015
PLANETA 64" WITH EXTENDED DELIVERY	MODEL NO. A-2018

W018928

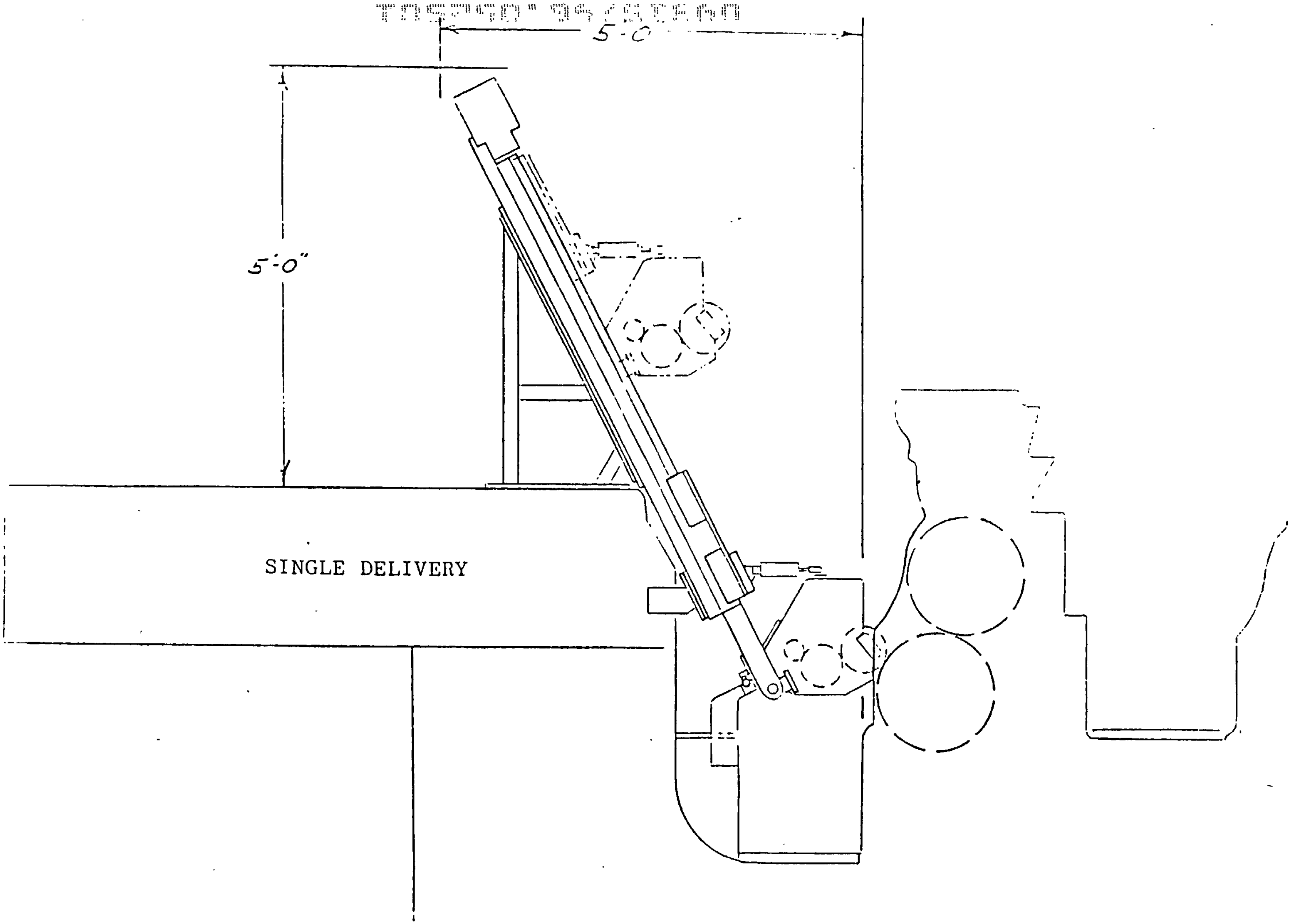


PRESS

MIEHLE 60"

RAPIDAC BLANKET COATER

MODEL NO. A-2021



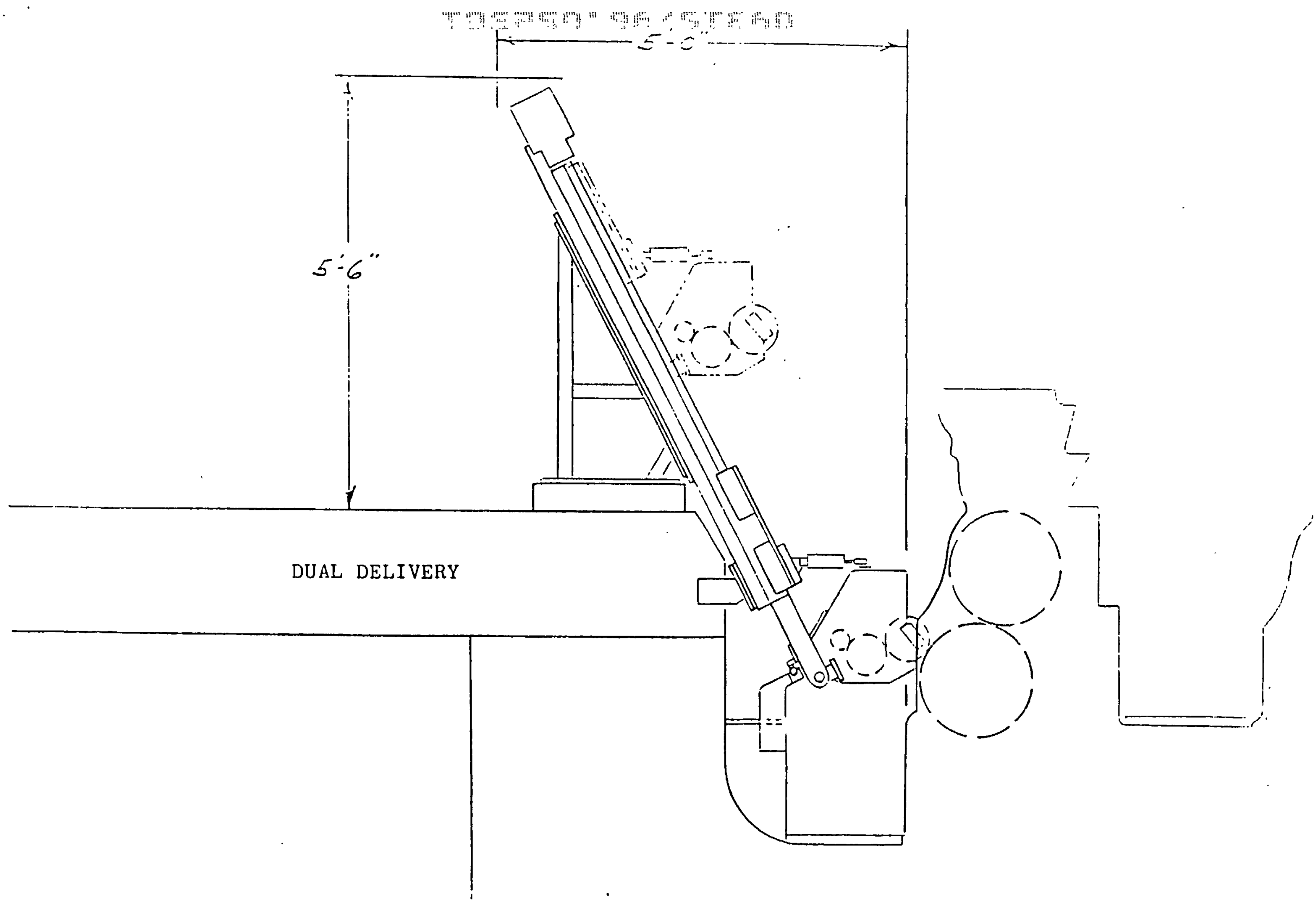
PRESS

HARRIS 60" EARLY MODEL (SINGLE DELIVERY)

RAPIDAC BLANKET COATER

MODEL NO. A-2024

W018930



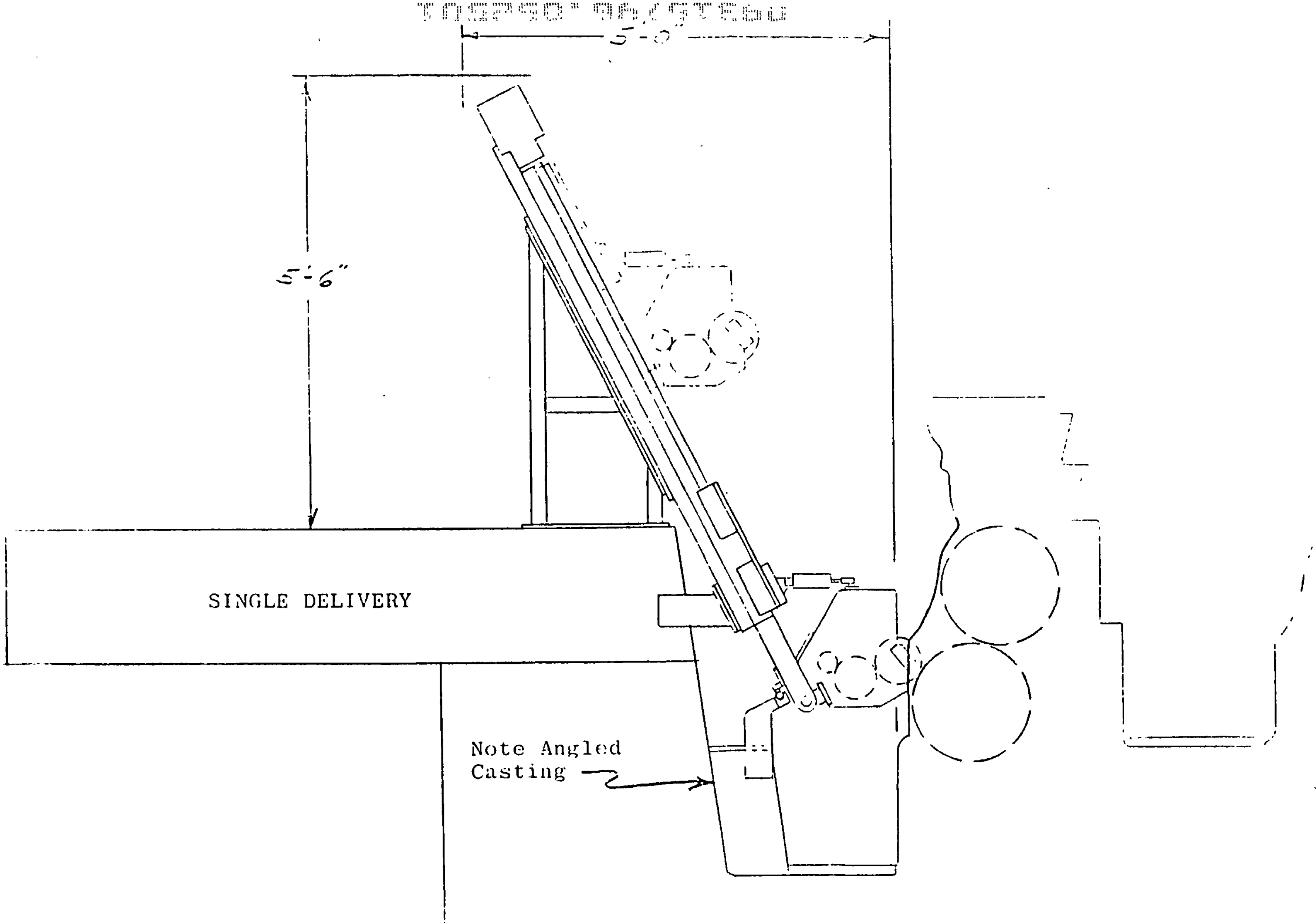
PRESS

HARRIS 60" EARLY MODEL (DUAL DELIVERY)

RAPIDAC BLANKET COATER

MODEL NO. A-2028

W018931

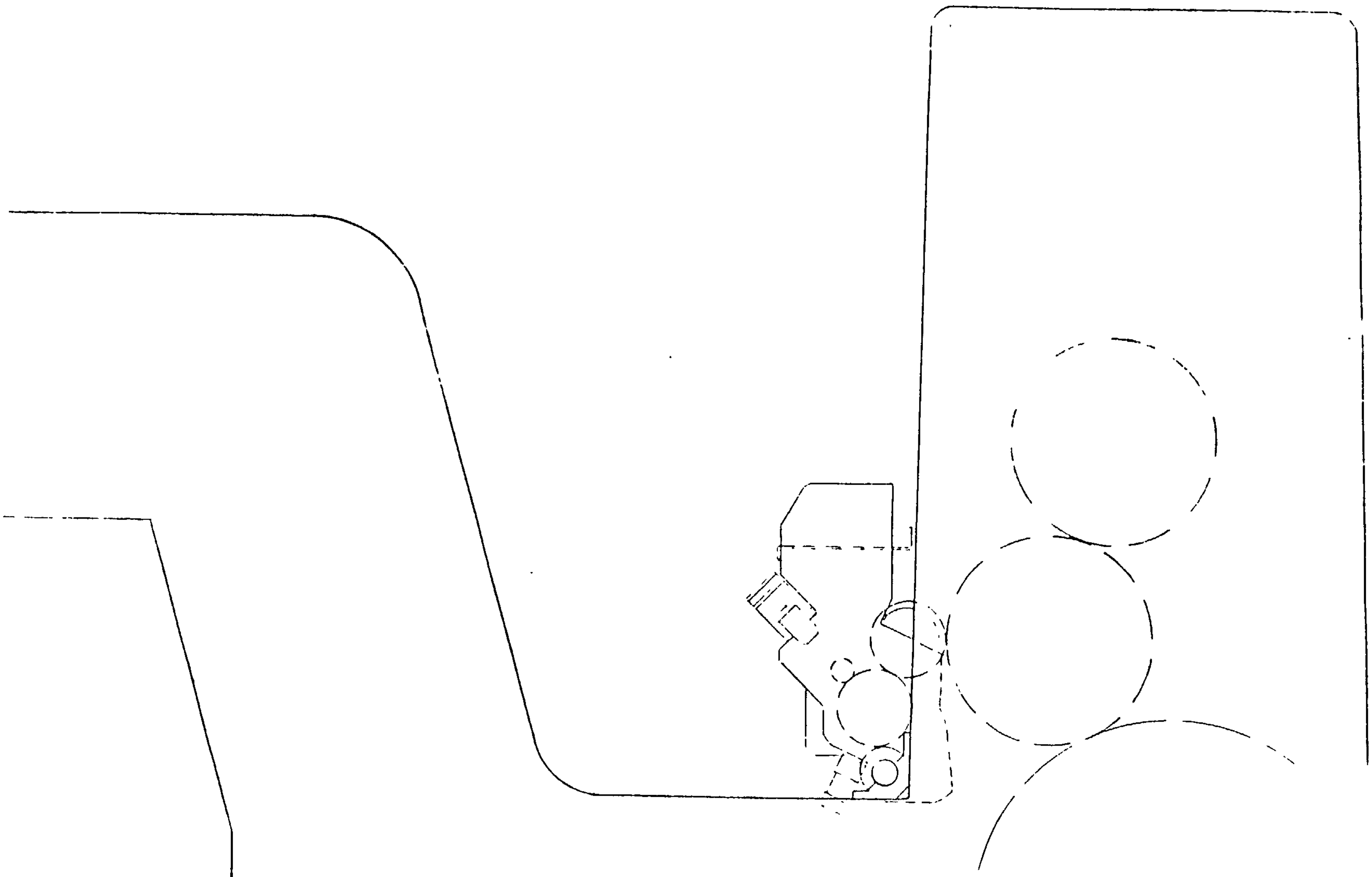


PRESS

HARRIS 60" LATE MODEL (SINGLE DELIVERY)

RAPIDAC BLANKET COATER

MODEL NO. A-2029



PRESS	RAPIDAC BLANKET COATER
PLANETA 50"	MODEL NO. A-2031
PLANETA 55"	MODEL NO. A-2033
PLANETA 64"	MODEL NO. A-2035

9

DAHLGREN®

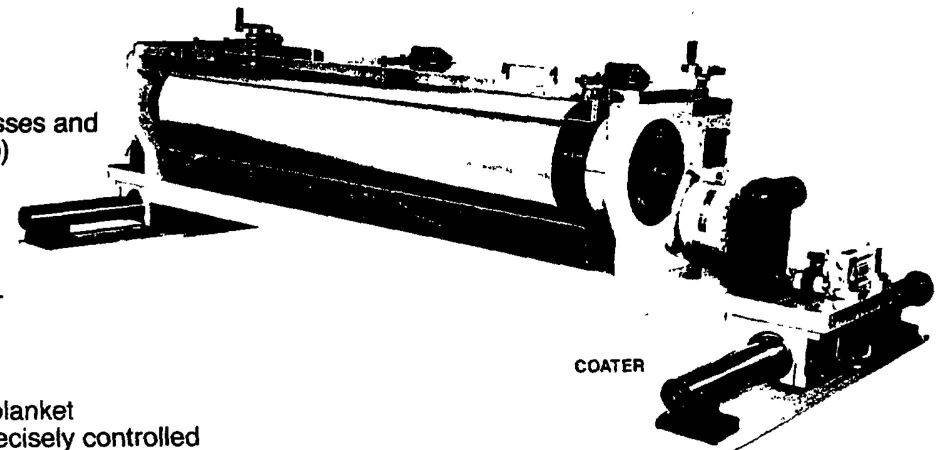
Product Data Bulletin

Blanket Coater

FOR:
The coater is designed for retrofit on new or existing offset SHEET-FED presses and may be used for both in-line (wet-trap) as well as off-line (dry trap) applications.

The Blanket Coating unit is used in conjunction with the last printing station of the offset press to apply protective, high gloss and blister seal coatings over wet or dry surfaces, with optimum efficiency.

Coatings are delivered to the offset blanket directly from a gravure cylinder in precisely controlled amounts and then transferred to the substrate with a high level of uniformity and consistency.

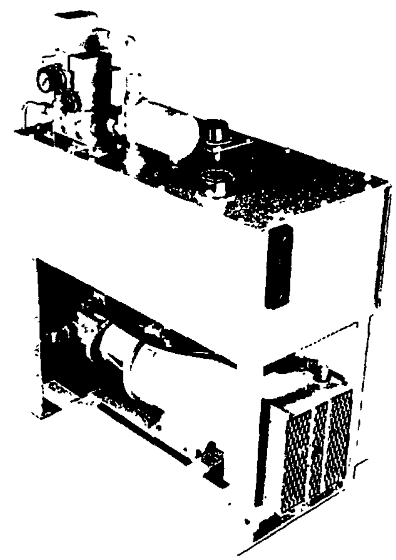


COATER

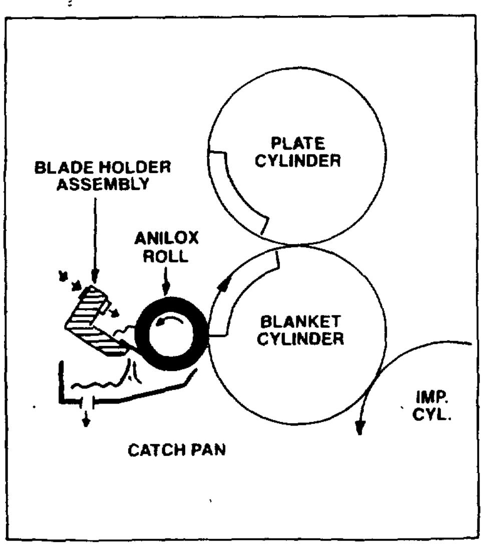
DOMESTIC AND FOREIGN PATENTS ISSUED AND PENDING

Various types of coatings can be used interchangeably with the coater including aqueous and U.V. curables. Substrates of varying nature such as paperboard and plastics may also be used.

The entire Coating System consists of the coater, coating supply and circulating system, plus a drying system. (See separate data sheets for dryers.)



HYDRAULIC DRIVE UNIT



SCHEMATIC DESCRIPTION:

Coating is accomplished with a single gravure roll in pressure contact with an offset press blanket. Coating on the blanket is then applied to the previously wet (or dry) printed sheet. Enroute to the delivery, the sheet is dried with Dahlgren heating lamps and forced air.

A uniform quantity of coating is continuously offered to the press. While the blade removes excess coating from the surface of the roll, engraved cells (voids) on the surface, carry a pre-selected precise volume of coating to the blanket. Coating removed from the cells by the blanket are replenished upon rotation to a flooded-nip at the blade/roll interface. Coating not removed by the blanket is re-wetted at this nip. Accumulation, starvation, roll run-out, streaks, etc., are non-existent. The roll is positively driven in both "On" and "Off" positions. Fresh coating is continuously circulated through the coater. Coat weight may be varied by varying the speed of the anilox roll.

W018935

STANDARD FEATURES

- Rugged, unitized construction for bolt-on adaptation to press frames. Horizontal actuation and retraction from press blanket.

APPLICATOR ROLL ASSEMBLY:

Precision engraved surface (copper, nickel and chrome plated).
Statically and dynamically balanced.
Pre-selected volume carrying capacity meeting specific customer coat weight requirements.
Hydraulically driven at press speed for spot-coating, or, at varying speeds for overall coating.
Mounted in heavy-duty, oversized, anti-friction bearings.
Accurately positioned and positively forced (locked) against press mounted "ON" stops. Automatic on-off w/press impression circuit.

DOCTOR BLADE HOLDER ASSEMBLY:

Cast iron holder.
Adjustable pressure capability of blade to coater roll with "Max" pressure limiting stops.
Flexible, replaceable, "blue-steel", hardened and tempered doctor blade; ground doctor surface.
Fixed-angle "wiping" design for doctor blade.

- Coating catch pan under blade holder and coating roll.
- Electrical probes sensing coating flow and level at coater inlet and in catch pan.
- Hinged, aluminum tread plate over blade holder assembly and coating roll. Serves as bench when cleaning or changing blanket.
- Hydraulic power unit, pre-plumbed and tested with 20 gallon reservoir and 5 H.P., TEFC motor and fixed displacement pump. Flow-control valves for hydraulic motor and actuation cylinders at coater unit.
- Unit control station with oil-tight enclosure and operator devices.
- "NEMA 12" power control cabinet with control circuit isolation transformer.

CIRCULATION SYSTEM:

Feed and return, constant displacement pumps.
Variable air drive to pumps.
Positive drain and return of coating to drum.
Quick-disconnects at coater head, catch pan and supply drum.
Quick-disconnects for customer furnished wash-up lines.
¾" I.D. flexible, vinyl tubing.

BENEFITS:

- System performance (coater + dryer) guarantees.
- Operational simplicity, low maintenance, long life, safe.
- Short make-ready and clean-up.
- Ready access to press blanket when coater is not in use.
- Applies precise, consistent quantity of coating; repeatable.
- Coating is smooth, uniform and has high rub resistance and gloss.
- Elimination of spray powder and associated problems.
- Positive "ON", no bounce in cylinder gap (streak-free).

OPTIONAL EQUIPMENT:

- Custom designed coater retraction systems/patented
- Custom designed coating circulation systems
- Viscosity monitor and control
- Ratio speed meter modification

ELECTRICAL/PNEUMATIC INPUT REQUIREMENTS:

230 VAC ± 10%, 3 PHASE, 50/60 HZ ± 2 HZ (25 amps:10 KVA)
400 VAC ± 5%, 3 PHASE, 50 HZ ± 2 HZ (15 amps:10 KVA)
460 VAC ± 10%, 3 PHASE, 60 HZ ± 2 HZ (15 amps:12 KVA)
85-100 PSI Air Pressure; 120 PSI, max.

SHEET-FED PRESSES DESIGNED FOR:

Aurelia	**Harris**	**Marinoni**	**O.M.C.S.A.**
Bobst	**Heidelberg**	**Miehle**	**Planeta (Royal Zenith)**
Color Metal	**Komori**	**Miller**	**Solna**
Crabtree	**M.A.N.**	**Mitsubishi**	**Miehle/Roland (I/C)**
Halm	**Mann**	**Nebiolo**	

WARRANTY SERVICE:

Installation and start-up supervision • 90 day service warranty • 6 months gravure roll warranty • 12 months—other parts warranty

Dahlgren USA, Inc.
P.O. Box 115140
Carrollton, Tx 75011-5140
tel: (214) 245-0035 • wats: 800/527-5301 • fax: (214) 245-0768

W018936

10

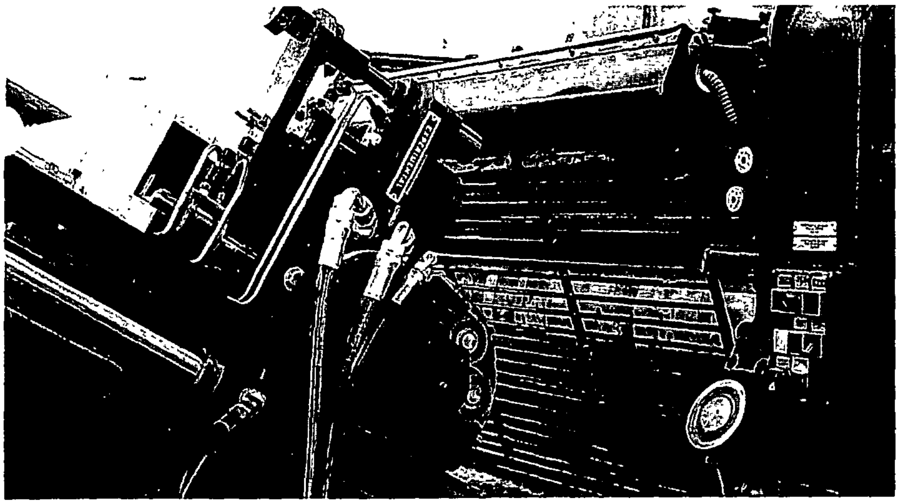
What would you say if we told you you could get 5 impressions out of your 4-color press?

W018938

Believe it!

Dahlgren's new LithoPlus™ Coating System gives you an extra impression on your 2, 4, 5 and 6-color Heidelberg Speedmaster!

W018939



It sounds incredible. And it should! Until now, no one has been able to print *and* coat in a single pass, without giving up a station. That is, until Dahlgren introduced its new LithoPlus Coating System, designed specifically for the Heidelberg Speedmaster press.

In simplest terms, the Dahlgren LithoPlus Coating System is an add-on blanket cylinder that fits onto the last printing station of your Speedmaster press. With it, you can print and coat in-line, for overall or spot coverage, using U.V., aqueous or varnish coatings. Your customers get added gloss and scuff resistance. Your pressroom dramatically reduces spray powder usage and turnaround time. You save press time, floor space and money.

What's more, you can bill the premium price coating jobs demand, while completing the work in a single pass for better quality. Savings. Quality. Profits. Why hasn't anyone thought of this before?

How the patented Dahlgren LithoPlus Coating System works.

The Dahlgren LithoPlus Coating System was engineered to function as an addition to your Heidelberg Speedmaster press. It is solid, well-designed and compatible with any 40", 28" or CD model. And once it's in place, it never needs to be removed. Just retract the unit when you're not using it, move it back when you're ready to coat. Clean-up and set-up take only a few minutes.

The coater is held in place using a combination of electromagnets and hydraulics, against positive, adjustable stops, that prevent chattering and bouncing. The unit's safe, aluminum add-on cylinder is geared directly to your press, with electrical interlocks to assure proper alignment. When the press and system are turned on, gears drive the coater in synchronization with your press, allowing you to run at full production speeds. Coating and drying occur after the last color application, and coat weight can be varied as desired.

Custom-engineered installation by trained Dahlgren technicians is included in your LithoPlus Coating System purchase. We ensure that your installation meets the precise tolerances of your press. We'll train your people to use the system according to your specifications. And like all Dahlgren products, the LithoPlus Coating System is guaranteed or your money back.

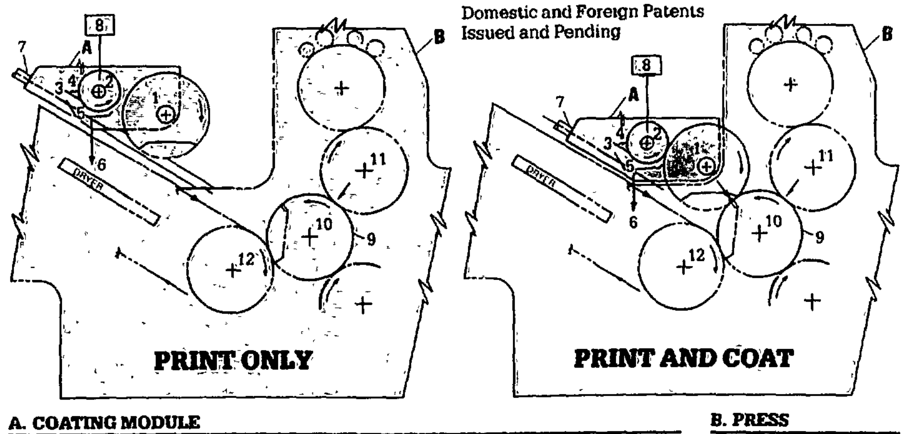
Dahlgren coaters deliver consistent quality, sheet after sheet at your production speeds.

Whether you're running paper, board or virtually any other substrate, your Dahlgren coater will provide uniform coating over your entire run. No slinging, streaking, ridging or unnecessary orange peeling. When you run a Dahlgren, you get total control.

Schematic Description:

Coating is accomplished with a single engraved roll in pressure contact with an add-on coating blanket cylinder. Coating on the coating cylinder is then applied to the previously wet (or dry) printed sheet. Enroute to the delivery, the sheet is dried with a Dahlgren drying system and forced air.

A uniform quantity of coating is continuously offered to the coating cylinder and sheet. While the blade removes excess coating from the surface of the roll, engraved cells (voids) on the surface, carry a pre-selected, precise volume of coating to the coating cylinder blanket. Coating removed from the cells by the coating blanket are replenished upon rotation to a flooded-nip at the blade/roll interface. Coating not removed by the blanket is re-wetted at this nip. Accumulation, starvation, roll run-out, and streaks, are non-existent. The coating roll is positively driven in both "on" and "off" positions and can be varied as required. Fresh coating is continuously circulated through the coater.



A. COATING MODULE			B. PRESS
1. COATING CYL.	5. COATING CATCH PAN	8. CONTROL STA. & VARIABLE SPEED DRIVE	9. SHEET
2. ANILOX ROLL	6. COATING CIRCULATION SYS.		10. IMPRESSION CYL.
3. BLADE	7. RETRACTION SYS.		11 BLANKET CYL.
4. COATING (AQUEOUS-UV)			12. SHEET TRANSFER SYS.

See for yourself. Call Dahlgren today!

As a Heidelberg Speedmaster owner you can't afford not to investigate the benefits of Dahlgren's new LithoPlus Coating System. It saves time. It improves the quality of your work. It can make you money.

For information, contact Dahlgren toll-free at 1-800-527-5301 ext. 128 today. Seeing is believing. The LithoPlus Coating System is here!

Dahlgren LithoPlus™ Coating System

Benefits:

- System performance (coater + dryer) guaranteed to your specification. Operational simplicity, low maintenance, long life, safe.
- Short make-ready and clean-up.
- Ready access to press when coater is not in use.
- Applies precise, consistent quantity of coating; repeatable.
- Coating is smooth and uniform.
- Reduction of spray powder and associated problems.
- Positive "on" no bounce in cylinder gap (streak-free).

System Integration:

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Coating Cylinder Assembly:

- Synchronized drive from press.
- Electro/magnetic start up safety provisions.
- Durable construction.
- Adaptable for blankets or photopolymer plate.
- Provision for plate registration.

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- Flexible, replaceable, "blue-steel," hardened, tempered and ground doctor blade.
- Fixed-angle "wiping" design for doctor blade.

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- Feed and return, constant displacement pumps.
- Variable speed air-motor drive to each pump.
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- 3/4" I.D. flexible, vinyl tubing.
- Liquid level high/low controls.

Other Features:

- Coating catch pan under blade holder and coating roll.
- Electrical detectors sense coating flow and level at coater inlet and in catch pan.
- Hinged, clear plexiglas cover over blade holder assembly and coating roll.
- Hydraulic power unit, pre-plumbed and tested with 20 gallon reservoir and 5 H.P., TEFC motor and fixed displacement pump. Flow-control valves for hydraulic motor and actuation cylinders at coater unit.
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- "NEMA 12" power control cabinet with control circuit isolation transformer.

Optional Equipment:

- Custom designed coating circulation systems.

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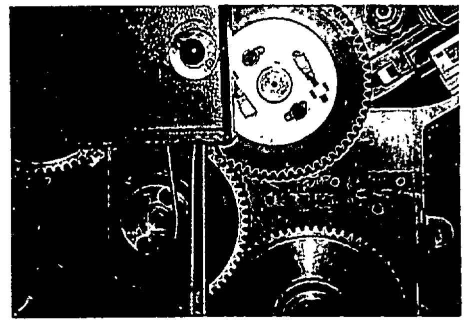
- 85-100 PSI Air Pressure; 120 PSI, max.

Warranty Service:

- Installation and start-up supervision.
- 90-day service warranty.
- 6 months anilox roll warranty.
- 12 months all other parts warranty.



Printed four colors plus coating in one pass on a four color Heidelberg Speedmaster equipped with a LithoPlus Coater and Dahlgren Dampeners using Sinclair and Valentine inks and Algan coating. Cyrel® photo polymer plate furnished by DuPont.

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P.O. Box 115140 Carrollton, TX 75011

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One roll outshines them all.

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W018941

11

What would you say if we told you you could get 5 impressions out of your 4-color press?

W018943

Believe it!

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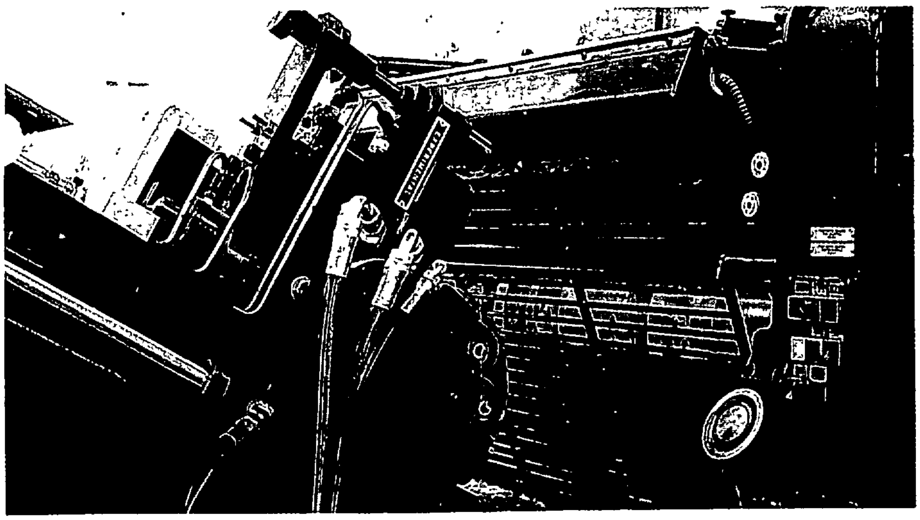
W018944



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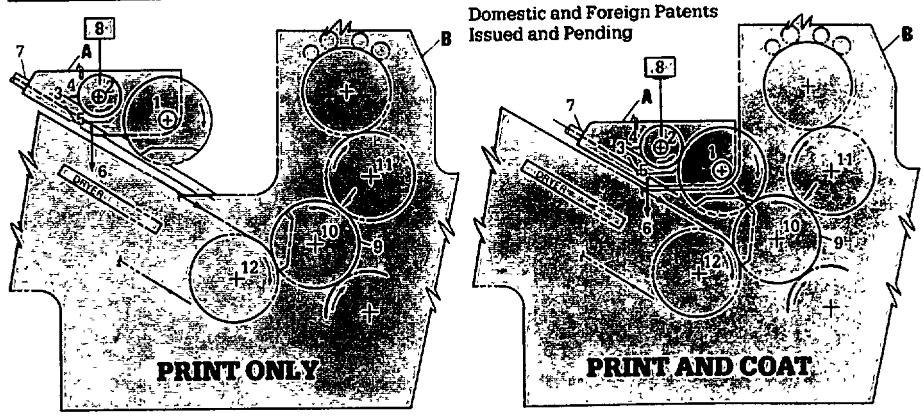
Domestic and Foreign Patents Issued and Pending



A. COATING MODULE

1 COATING CYL.
2. ANILOX ROLL
3. BLADE
4 COATING (AQUEOUS-UV)
5. COATING CATCH PAN
6. COATING CIRCULATION SYS.
7 RETRACTION SYS.
8. CONTROL STA & VARIABLE SPEED DRIVE

B. PRESS

9. SHEET
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- 90-day service warranty.
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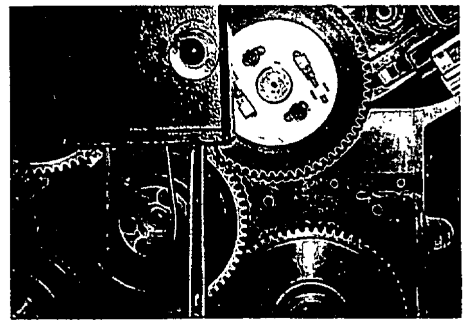
- 12 months all other parts warranty.



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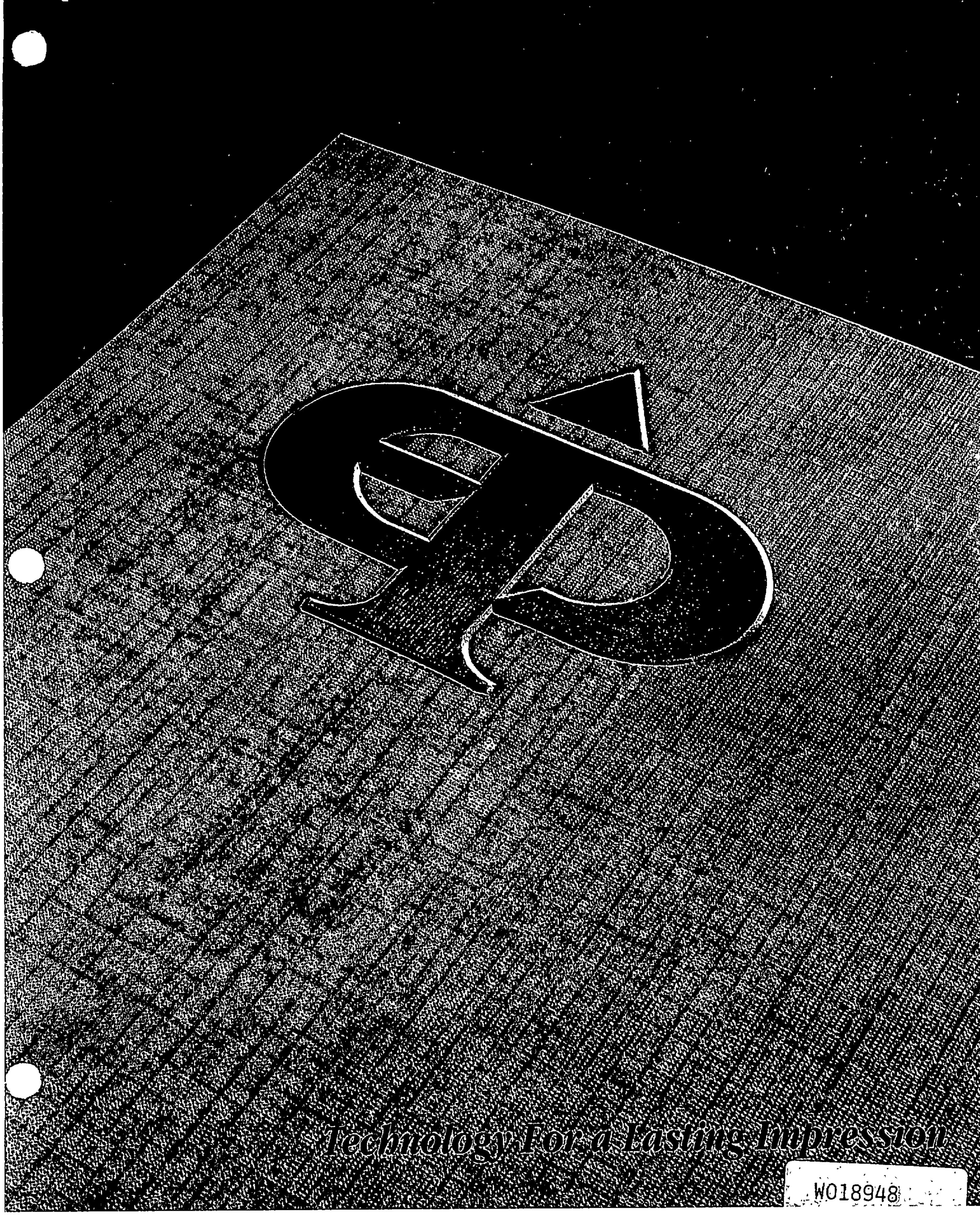
12

Epic Products



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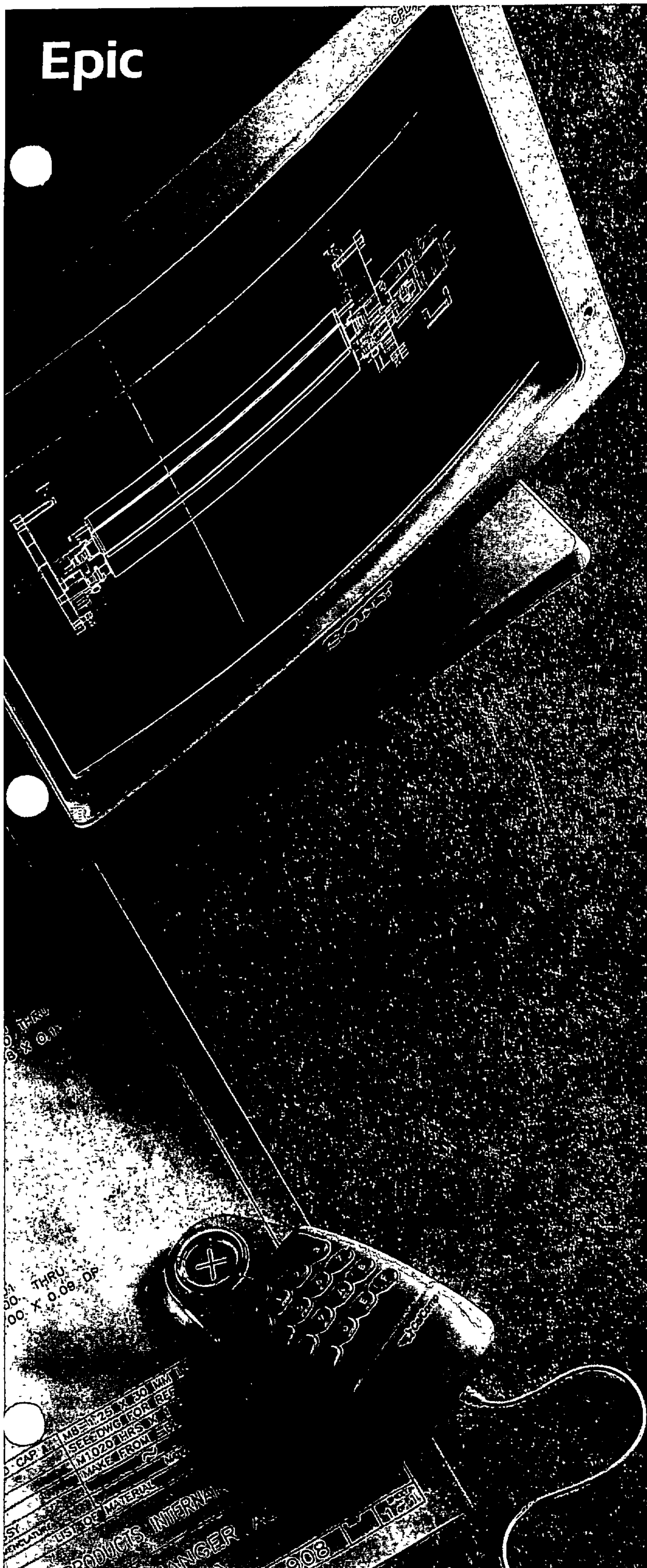
Epic



Technology for a Lasting Impression

The Epic Commitment

Epic Products International Corporation is an engineering and manufacturing organization committed to developing printing press accessory equipment that enhances the quality and productivity of the printing process. In striving to improve printing techniques through advanced designs, we have furthered the state of the art of the printing industry. Our patented Delta technology, which removes particles from the plate cylinder during printing to reduce hickeys and other visual defects, is evidence of our continuing dedication to progressive designs that make a lasting impression.

Epic offers an array of quality-enhancing continuous dampening systems, coating systems and drying systems for sheetfed and web presses, as well as the capability to integrate our technology into existing customer systems and presses. Our commitment to ensuring print quality through our products and technology is so strong that our products and services carry a full money-back guarantee.

Our markets include national and international customers in the commercial printing, folding carton, metal decorating, business forms, and converting industries.

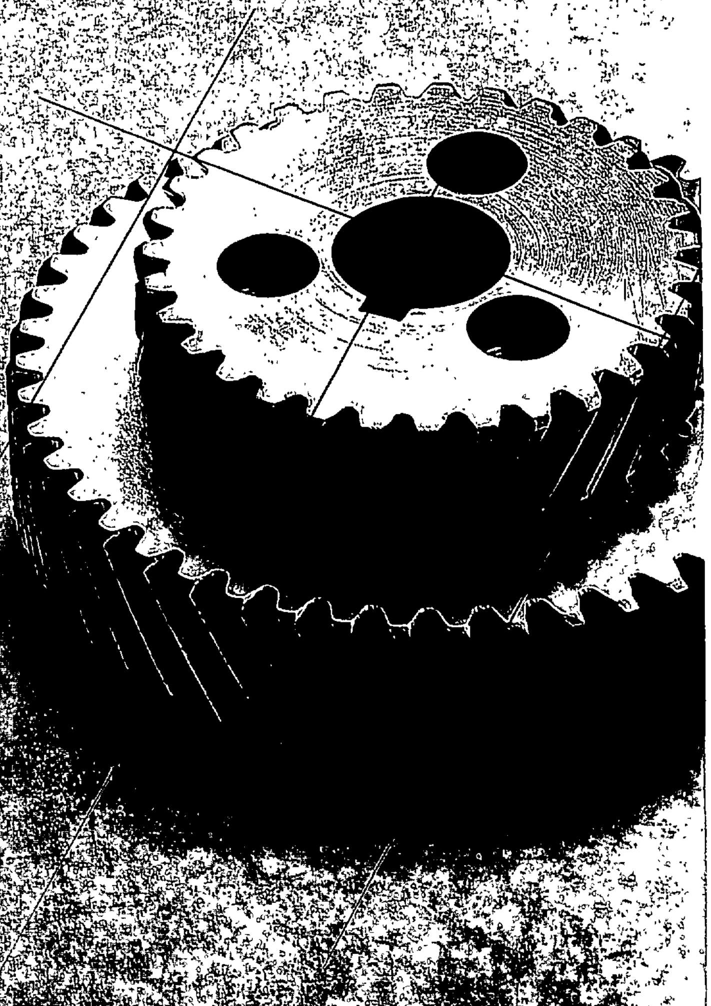
Engineering Solutions and Capabilities

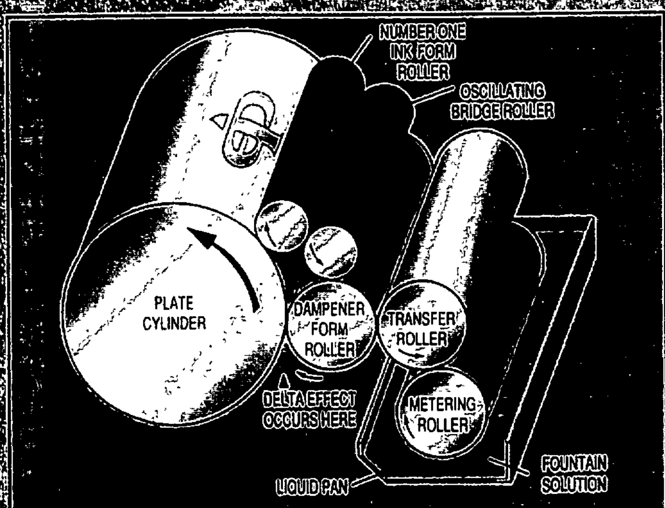
Epic believes in meeting customer needs through creative engineering solutions, in addition to delivering product. Our engineering staff possesses years of experience in the printing industry. Using hands-on knowledge coupled with advanced tools such as Computer Aided Design, they can design accessories, special configurations, and retrofits to accommodate unique requirements.

The "Delta Effect"

Breakthrough Technology for Achieving Zero Defects

Epic's patented Delta technology is a revolutionary breakthrough in the prevention of hickeys and other defects during the printing process. A valuable addition to any zero defect program, the unique Delta design utilizes helical gears and positive roller settings to drive the dampening form roller at a slower surface speed than the plate cylinder. This differential motion, called the "Delta Effect," wipes away the foreign particles that cause hickeys, while continually allowing a fresh charge of ink to the plate.





Eliminating Hickeys Once and For All

The "Delta Effect" removes virtually all plate-caused hickeys during printing. In fact, the Delta design has been proven so effective that all Delta systems come with a no-risk, money-back guarantee promising 98% elimination of all plate-caused hickeys.

Delta technology replaces hickey picker rollers and the time-consuming maintenance that accompanies them. Delta improves productivity and minimizes waste by eliminating the starts and stops that are often associated with hickey removal.

Safety is another important benefit. With the Delta system, the use of hickey picking sticks is unnecessary, and press operators have no contact with the plate while the press is running.

The Delta Design

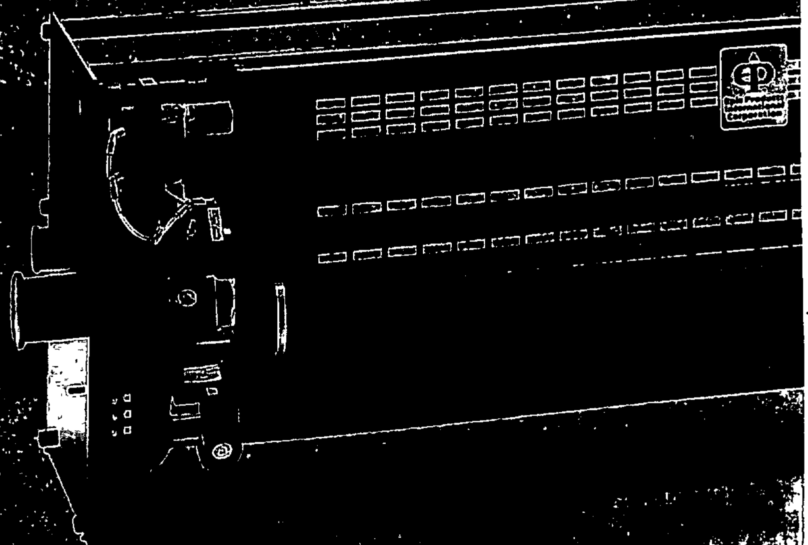
W018950

The Delta Print Quality System

[illegible] Quality Impression with [illegible] . . . Time After Time

The Delta Print Quality System is a combination of the exclusive "Delta Effect" with a uniquely engineered continuous dampener that features a range of quality enhancing features. The system allows printers to produce high-caliber materials that make a favorable impression [illegible] consistently.

In fact, the Delta Print Quality System provides such high quality, defect-free printing that printers around the world have specified it to replace the press manufacturers' own continuous dampeners on new presses prior to delivery.



Achieving A Sharper Image

In addition to preventing hickeys, the Delta Print Quality System produces sharper images and richer, more brilliant solids.

The dampener is plate-fed with a dampening form roller separate from the inking system, allowing for the retention of all ink form rollers. With a separate variable speed drive motor and water control adjustments, a precisely metered, extremely thin film of dampening solution can be evenly applied across the plate. The dampening solution is circulated, filtered, and held at a constant level and temperature by the refrigerated circulator. Precise control of the fountain solution and ink-to-water balance result in more consistent runs and faster make-readies. Fuller and smoother solids, sharper halftones, and improved print fidelity are achieved automatically and with a reduced amount of ink.

In addition, ghosting can be reduced with the use of another exclusive Delta feature, the air-activated oscillating bridge roller. This bridge roller may be installed or removed within minutes, providing the flexibility to print a variety of forms.

The Delta Print Quality System uses helical gears to give more gear surface contact, resulting in smoother, quieter, and longer-lasting operation. The entire system is built with the same quality and attention to detail found in the finest commercial presses.

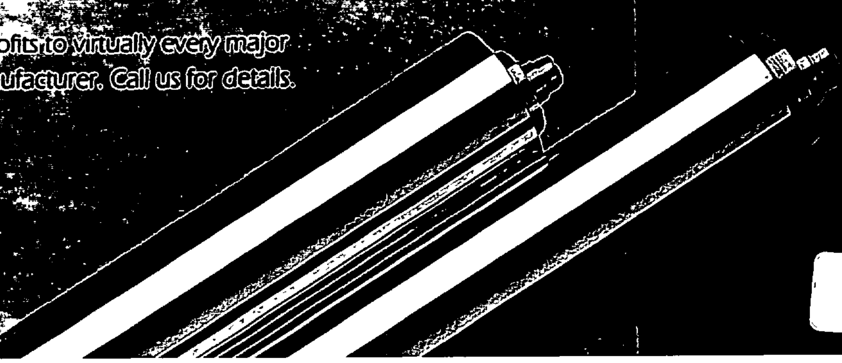
W018951

Retrofitting the Delta System

Epic can retrofit the Delta Print Quality System to a variety of sheetfed and web offset presses and configurations.

The system is frequently specified as a replacement for the press manufacturer's continuous dampener prior to delivery of a new press, or as a retrofit to both conventional and continuous dampening systems of older presses to extend their useful lives.

Epic has made Delta system retrofits to virtually every major model of every major press manufacturer. Call us for details.



Key Benefits of the Delta Print Quality System

- Hickey-free printing
- Improved print fidelity
- Denser, more consistent solids
- Sharper images and cleaner reverses
- Reduced ghosting
- Easy adjustment for faster make-readies
- Increased operator safety
- Instantaneous control of ink-water balance
- Lower ink usage, reduced downtime, and less waste
- Faster color response
- Maintains the design integrity of press ink train

W018952

Technical Specifications

Delta In-Line Coater/Dampener

The Delta In-Line Coater/Dampener applies a continuous, uniform, metered film of aqueous or U.V. coating directly to the plate cylinder. Positive roller settings ensure precise control of coating transfer. Coat weights can be varied by turning the potentiometer speed control.

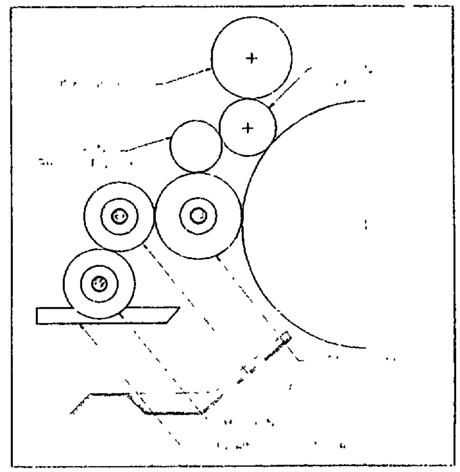
Quick changeover to printing is handled easily. In this mode, the unit functions as Epic's well-known Delta Print Quality System, which combines continuous dampening with the patented differential "Delta Effect" to eliminate hickeys.

For overall coating, a standard offset plate can be used to transfer the coating via the offset blanket to the sheet. Spot coating can be achieved by mounting a relief plate on the plate cylinder. The spot coating image can then be precisely registered by plate cylinder movements, as easily as a printed image.

Specifications include:

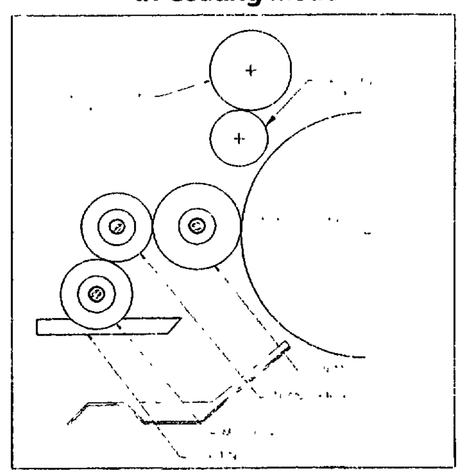
- Resilient covered form and metering rollers
- Motor driven transfer and metering rolls
- Electronic interlink with all press sequences
- Gear driven form roller
- Solid state drive
- Pneumatic actuation
- Refrigerated circulators
- Positive displacement coating pump
- Pneumatically operated oscillating bridge roller

Delta Coater Dampener In Printing Mode



View Looking Inside OS

Delta Coater Dampener In Coating Mode



View Looking Inside OS

Epic Delta In-Line Coater/Dampeners are in use on virtually all types of sheetfed offset presses.

Call 1-817-640-3037

W018953

Epic Products International Corporation
2801 E. Randol Mill Road • Arlington, Texas 76011 • Phone (817) 640-3037 • Fax (817) 633-3085
Specifications are subject to change without notice

Delta Coater/Dampener

Versatility: it's a key factor when you are considering in-line coating technology.

You require precision equipment that provides consistent quality.

You need to be able to change over to printing with ease.

You demand a proven yet cost-effective system . . . from a manufacturer with a reputation of quality performance. You can rely on Epic.

Guaranteed High Quality Performance — with Epic technology

Epic's Delta In-Line Coater/Dampener has a successful industry track record in the application of aqueous or U.V. coatings in-line, over wet ink. Superb, reliable performance is guaranteed. Coatings are laid with smooth, uniform consistency to provide flawless quality. What's more, since the Delta In-Line Coater/Dampener replaces the existing press dampening system and is designed for easy changeovers between coating and printing, it does not require the addition of a bulky retraction mechanism.

Benefits of the Delta In-Line Coater/Dampener include:

- Smoother finish and higher gloss than press varnish
- Superior scuff resistance
- Increased productivity due to the elimination of secondary operations
- Faster handling of jobs, since the coatings dry before reaching the delivery
- Ability to spot coat in register
- Quick changeover from coating to printing
- All the benefits of the Delta Print Quality System in the printing mode, including hickey-free printing, sharper images and reduced ghosting

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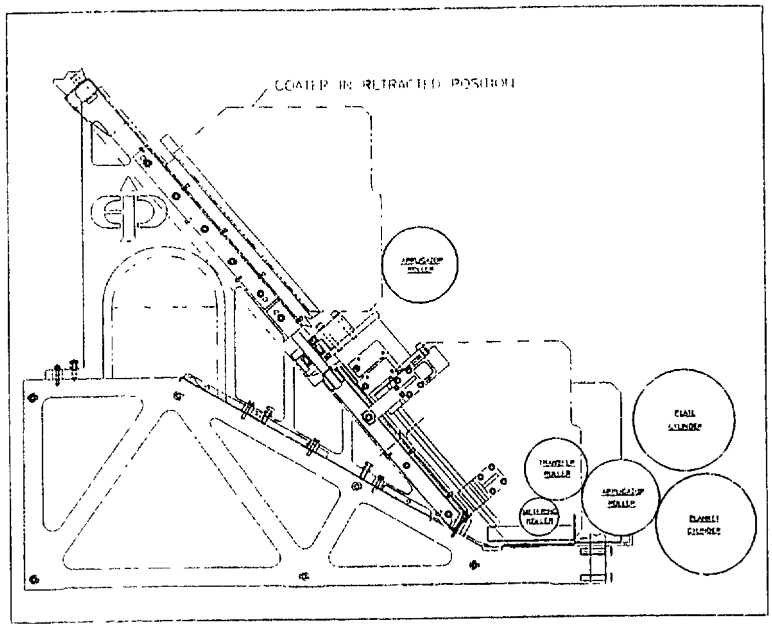
Technical Specifications

Blanket Coater

The Epic In-Line Blanket Coater applies a continuous, uniform, metered film of aqueous or U.V. coating directly to the blanket cylinder. This allows the coating to be transferred directly to the sheet in a smooth, uniform film, either spot or overall.



When used with a suitable curing system (also available from Epic), the coating dries before the sheet reaches the delivery, thereby allowing faster handling of jobs.

The proven three roll design does not require roll changes for various coating weights or varnishes. Partial or full retraction can be provided depending on accessibility requirements.

Specifications include:

- Three roll design allowing application of varying coat weights
- Independent variable speed drives
- Single panel control station for operation of all coating functions
- Stainless steel coating pan
- Positive displacement coating pump
- PLC Logic control for integration with press controls
- Brushless AC motors with inverter drives, designed to follow press speed

The Epic Retractable Blanket Coater can be installed on virtually any type of high pile sheetfed offset press.

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EPIC — Technology for a Lasting Impression

Blanket Coater

In-line coating: it's the wave of the future. Applying coatings in-line, over wet ink, is a faster, more efficient way to enhance your products without the need for varnish or excessive spray powders.

Yet how can you be sure of maintaining quality when you make the transition from traditional varnishing to in-line coating? Can you depend on the newer technology to produce the results your customers expect? And what about flexibility? Epic has the answer.

Reliability, Flexibility and a Superior End Product with the Epic In-Line Blanket Coater

Epic's In-Line Blanket Coater applies coatings in-line with uniform precision, providing a level of quality that can be repeated with consistency. Engineered for reliability, the system is industry-proven in presses around the world. Plus, the proven three-roll design permits the flexibility to apply various coat weights without the need for roll changes.

The Epic In-Line Blanket Coater provides:

- Smoother finishes and higher glosses than that obtained with conventional varnishes
- Superior scuff resistance
- Increased productivity due to the elimination of secondary operations
- Faster make-readies
- Faster handling of jobs, since the coatings dry before reaching the delivery
- Quick changeover from coating to printing

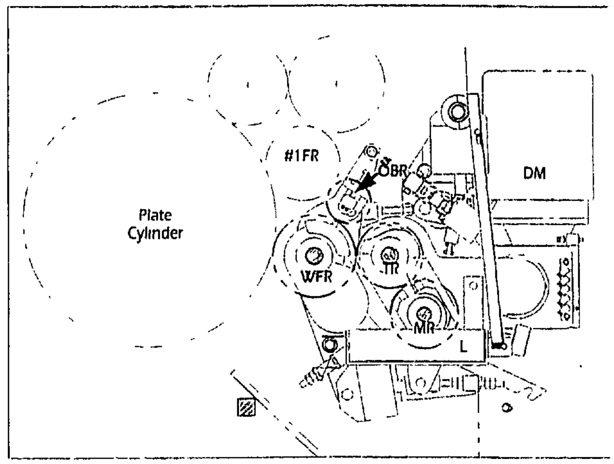
W018956

Epic Products International Corporation
2801 E. Randol Mill Road • Arlington, Texas 76011 • Phone (817) 640-3037 • Fax (817) 633-3085

Technical Specifications

General Information

- Ink-Water balance achieved quickly with absolute dampener control.
- Special Delta Drive Systems.
  - Splined, thru hardened steel Delta drive shafts
  - Case hardened, splined steel, helical gearing.
- Transfer and metering roller drive gears are case hardened helical gears.
- Pneumatically operated oscillating bridge roller.
  - The bridge roller can be made to oscillate or the bridge roller can be silent.
  - The bridge roller pneumatic system can be run integrated or non-integrated with the push of a button.
- Safety systems are standard
  - Safety guards with switches that deactivate unit and press when the guard is raised
  - Nip guards in the inturning nips where cleaning of rollers is required.
  - Safety liquid level systems that turn unit off if the liquid level drops below specified levels
- The Delta System prints drier, reducing emulsification in the inker



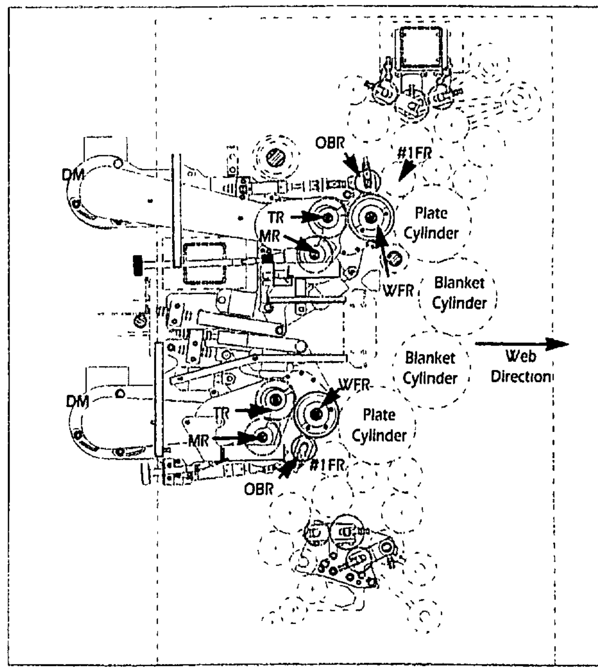
Commercial Sheetfed

#IFR: Number one ink form roller ▪ WFR: Water Form Roller ▪ TR: Transfer (Chrome) roller ▪ MR: Metering (Pan) Roller ▪ OBR: Oscillating Bridge Roller ▪ L: Liquid Pan ▪ DM: Drive Motor

Information on Web Dampeners

All the general items listed above plus these additional items

- The option of automatic lubrication system or integrating the dampener into the existing press automatic lubrication system
- Mirror finished chrome rollers to minimize ink feed back
- Each end of the oscillating bridge roller is covered with a rubber boot to keep contaminates out
- Large capacity spherical roller bearings are designed into each unit
- Brushless AC motors with inverter drives.
- PLC Logic allows for
  - Plate pre-wet
  - Speed following with individually trimmed units
  - Auto impression
- Plate following. Allows the water form to cock with the plate without having to readjust rollers
- The Delta System prints drier, reducing registration problems caused from paper stretch.
- Resilient rollers are covered with high temperature nitrile



Web Perfector

#IFR: Number one ink form roller ▪ WFR: Water Form Roller ▪ TR: Transfer (Chrome) roller ▪ MR: Metering (Pan) Roller ▪ OBR: Oscillating Bridge Roller ▪ L: Liquid Pan ▪ DM: Dampener Drive Motor

Epic can install the Delta Print Quality System as a standard on new presses or as a retrofit.

Call 1-817-640-3037

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Specifications are subject to change without notice

EPIC — Technology for a Lasting Impression

Commercial and Folding Carton Printing

Today's commercial and folding carton printers face greater challenges than ever before, from using recycled materials to meeting zero defects. Every brochure . . . every package . . . every printed carton must present a lasting impression of quality while winning environmental approvals. To address the varied, often conflicting demands of the day, these printers need highly creative solutions and tools.

Epic can help you print superior materials while reducing press down time, minimizing waste, and saving hours of product inspection.

Giving You the Technology to Achieve Zero Defects with the Delta Print Quality System

Epic's Delta Print Quality System, featuring patented Delta technology, allows sheetfed and web printers to:

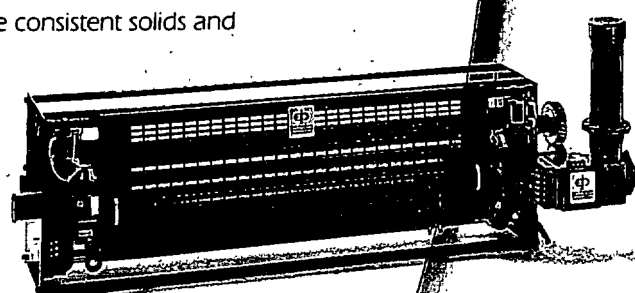
- Guarantee hickey-free printing — with no lost press time
- Reduce ghosting and streaking
- Print sharper images and cleaner reverses
- Gain precise control over ink-water balance — delivering denser, more consistent solids and truer colors
- Reduce waste by decreasing the stops and starts normally associated with hickey removal

"Since our Delta installation, we've gained almost total elimination of hickeys on our six-color press, and our overall quality is better than ever. Customer service has improved, too, since press checks go smoothly. There's no question that the investment was worthwhile."

Mike Patton, President
Creative Press, Inc.
Orange County, CA

"In the past, customers expected boxboard printing to have imperfections. We were allowed to have a certain number of hickeys, but we still had to print overruns. It was necessary to visually inspect every sheet in the entire job and sort out the bad ones. Now that we're running Delta, we've eliminated the hickey problem altogether."

Rolf Peterson,
Marketing VP
Royal Paperbox
Montebello, CA



100%, No-Risk Money Back Guarantee

If Epic Delta doesn't remove at least 98% of all plate-caused hickeys...we'll buy it back!

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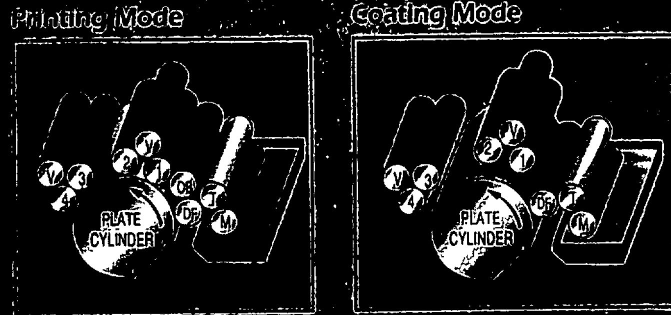
Coating Systems

[illegible]

[illegible] eliminating the [illegible]

[illegible] higher gloss, a [illegible] resistance compared to [illegible] aqueous coatings are gluable and can be hot stamped or over-printed.

[illegible] applies a continuous, uniform, metered film of coating directly to the plate cylinder. The coating dries before the sheet reaches the delivery, permitting faster handling of jobs. Overall or spot coating in register can be accomplished with the system. When used with Epic drying systems, the unit will allow in-line coating at rated press speed.

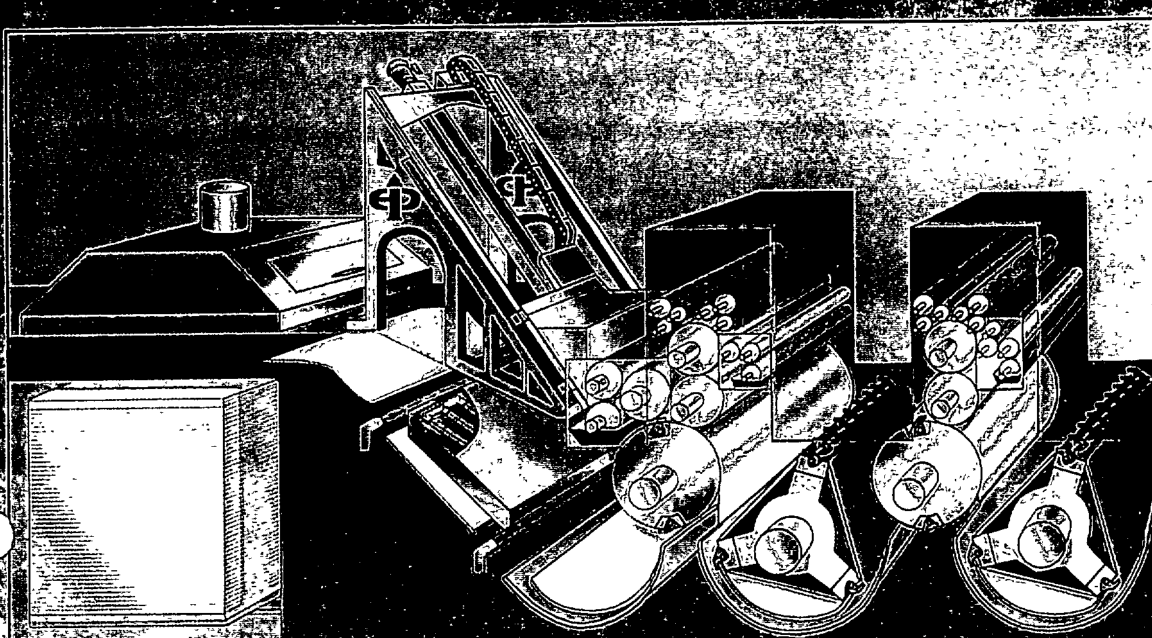


The Delta Coater/Dampener allows quick changeovers to the printing mode, in which the unit functions as a Delta continuous dampening system, providing high quality, hickey-free printing.

Three-Roll Blanket Coater

Stationary or Retractable

Epic Blanket Coaters apply aqueous or UV coating to the blanket cylinder of the press, permitting the coating to be transferred directly to the sheet in a smooth overall or spot film. The proven three roll design allows for application of various coating weights or varnishes without the need for roll changes. Epic Blanket Coaters are available in either stationary or retractable versions.



From left to right, this diagram illustrates the Press Delivery Evacuation System, Infrared-Convection Dryer with auxiliary Air Knives, Retractable Blanket Coater, Delta Coater/Dampener, and Delta Print Quality System. All equipment shown is manufactured by Epic Products.

W018959

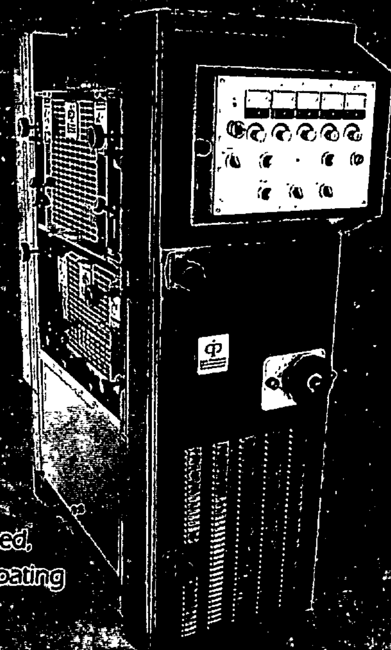
In-Line Web Coating

Adding Appearance Without Sacrificing Press Speed

Epic's In-Line Web Coaters help to enhance the value of any printed piece by adding attractive high gloss, rub resistance, oil or moisture resistance coatings in-line, without limiting press speed.

Single or Double Side

The In-Line Web Coater applies coating to either one side or both sides of the web without smearing or set-off. The system can apply a variety of coatings including water-based, solvent-based, catalytic or UV coatings on all types of paper. Regardless of press speed, coating is free of pin holes or streaks. Full or pattern coating systems are available.



The Finishing Touch

IR, UV and Convection Dryers

Epic designs and manufactures custom drying and curing systems for all types of sheetfed presses. Contact us for details.

From hickey-free printing with the Delta Print Quality System through coating and drying systems . . . on the most basic of single color presses to the most complete multi-color presses . . . encompassing commercial sheetfed and web, folding carton, forms, and metal decorating . . . Epic offers the technology and expertise you need to produce the highest quality printed products.

Lasting Support

After every installation, Epic offers continuing support. Updating configurations to changing needs, keeping customers current on new accessories, performing repairs, providing modifications, and training are all part of the Epic package. From helping our customers create lasting impressions to providing lasting service, we are dedicated to keeping our customers' press lines operating at productive, high quality levels.

Printed in the U.S.A. on a 6-color 40" press equipped with the Delta Print Quality System.

Specifications are subject to change without notice.

Epic Products International Corporation
[illegible] Arlington, Texas 76011 USA
Tel (817) [illegible] Fax (817) [illegible]

W018961

13

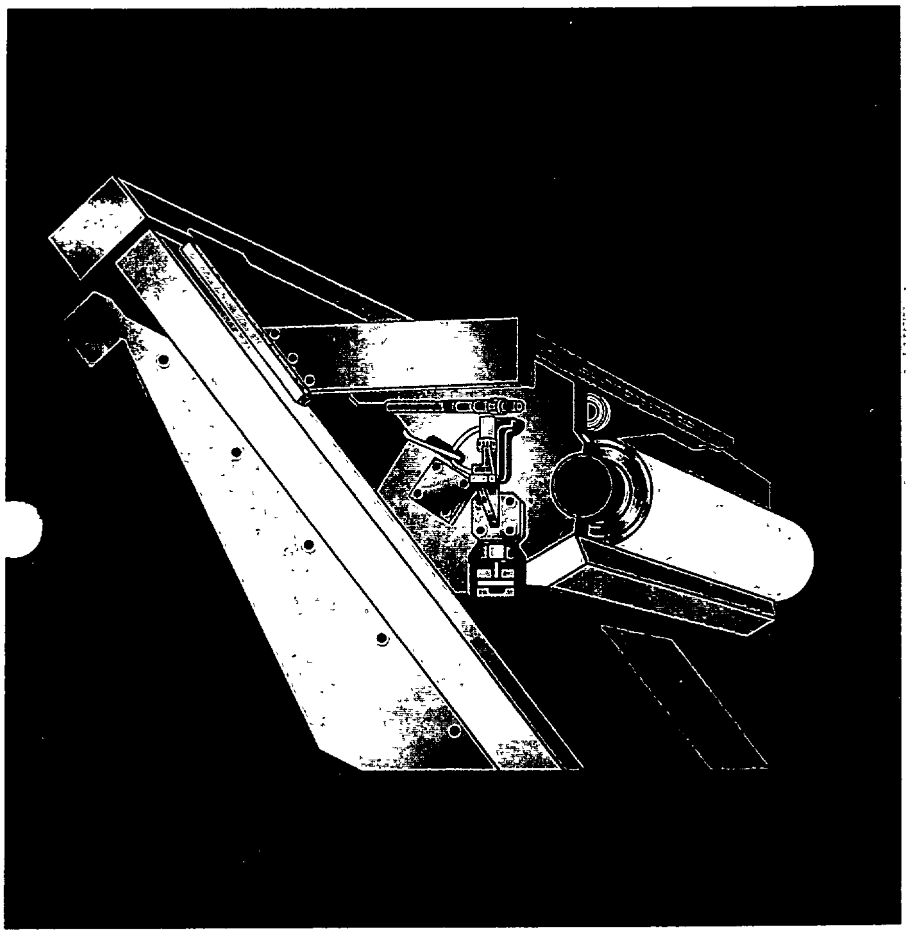
SUPER BLUE®

PBC PLATE/BLANKET AND PC PLATE COATER

BECAUSE TO MOST CUSTOMERS HIGH GLOSS MEANS HIGH QUALITY

W018963

It is now possible to dramatically increase gloss levels of printed sheets



Winner

Graphic Arts Technical Foundation

GATF

InterTech Award

High-impact quality at low cost

Among print buyers and consumers alike, "gloss" and "feel" are strongly associated with quality. Through our systems, printers can profitably achieve superb finish-quality and high-impact appearance at low cost.

Our Plate/Blanket Coater (PBC) maximizes your coating flexibility, giving you more precise control and broader capabilities than ever before. Offering full-coverage gloss or matte coatings as well as spot coatings of impeccable register and quality, the PBC smoothly and consistently applies uniform coatings of a wide viscosity range to any desired thickness.

- Precision spot-register applications
- Elimination of halos and hard/beaded edges
- Maximum coating application

The advent of coatable, water-based and UV-curable resins offers sheetfed color printers the unprecedented power to add high gloss levels, special effects and unusual surface treatments to their range of ***in-house*** capabilities. These coatings vastly exceed the gloss potential of varnish, while banishing forever the mess and quality problems spray powder causes in the pressroom.

Maximize press utilization while minimizing clean-up

Because the PBC is easily retracted when coating is not necessary, the press unit used for coating can function as a full printing unit whenever you need it. Or, you can easily establish a dedicated coating line on an under-used press. What's more, with our coaters, you will eliminate forever the press downtime associated with blanket cutting, packing and image registration. No other coater can accomplish this.

Our coaters minimize wash-up and makeready, offering unrivaled time and cost savings. Ruggedly constructed, easy to operate and maintain, our patented coaters are on the leading edge of industry technology.

W018964

- Makeready as fast as regular ink presses
- Elimination of slinging and misting problems
- Minimized wash-up times

Improved quality means customer satisfaction

The PBC provides unparalleled quality control, enabling you to coat with as much control as you print. Coating material is applied as if it were another ink color, using your printing unit as it was designed to operate — to lay down a precise film membrane on the substrate.

What's more, the PBC achieves this high-impact appearance in a fraction of the time it takes to varnish or laminate — and without the mess and quality control problems associated with these now obsolete methods. So your customers receive the highest quality product, with an incredibly fast turnaround.

Super Blue Plate/Blanket Coater

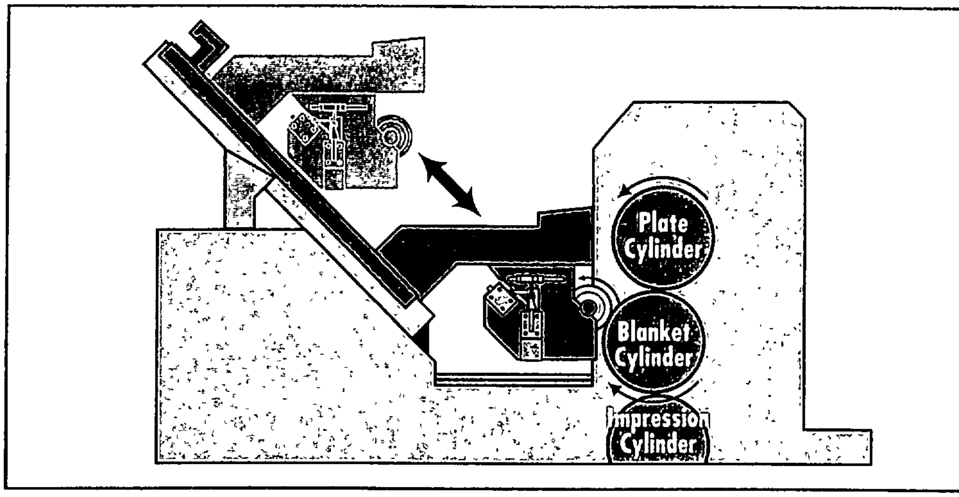
The PBC applies coating either at the blanket, for full coverage work, or at the plate, for precise register application of spot coating without hard edges. Or when coating is not necessary, it can be easily retracted to allow for regular printing uses. Unlike other coater designs that haphazardly squeeze coating material onto substrate under pressure — slinging coating material — the shear-coating PBC works neatly and precisely.

In the blanket mode when overall coverage is required, PBC's design provides for fast makeready and smooth application of the coating.

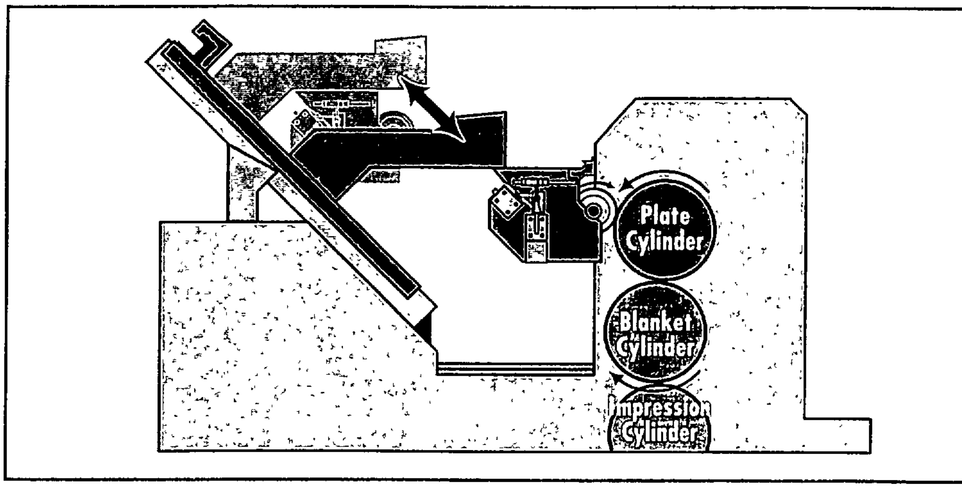
In the plate mode, the coater applies coating to a relief image on the plate cylinder to apply a uniform thickness of the coating film to the blanket cylinder. This coating "image" is then transferred by the blanket to the substrate, ensuring precise registration in all axes. Coating thickness and pressure between the plate, blanket and impression cylinders are all accurately and easily controlled.

Both the PBC and its Common Impression Cylinder (CIC) press counterpart, the Plate Coater (PC), improve operational profitability by eliminating the extensive "wash-up" downtime associated with coater dampeners — the only alternative with a CIC press. The typical two to three hour wash-up is reduced to less than a half hour, and the entire process is carried out independently from the press.

Being fully retractable, the coater does not interfere with the dampening system, ensuring fast changeover from print to coat and coat to print. This makes your entire operation more efficient *and* more profitable.



PBC in Blanket Position

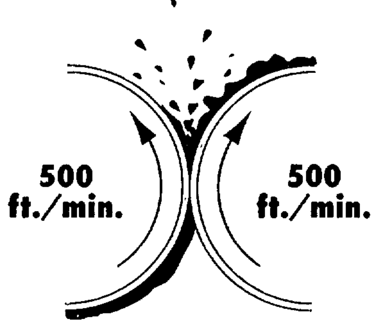


PBC in Plate Position

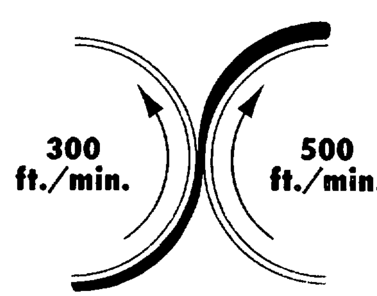
Productivity, safety and long-term value

As a supplier of precision-engineered coating and drying systems for the graphic arts and packaging industries, Printing Research, Inc.'s high-performance systems improve your bottom-line profitability by adding value to your existing operations. With our systems, you improve the quality of your services by becoming a low-cost provider of the highest quality printing — all while maximizing the utilization of your existing presses. Our dependable, high-performance systems will increase your sales, profits and customer satisfaction levels.

See the difference yourself. Experience a demonstration of our PBC and PC and witness how coatings can be as easy to handle and precise to apply as the ink used in daily printing!



NIP Application



SHEAR Application

W018965

Instant-drying inks and the elimination of spray powder have been the dream of every printer and printing buyer. The idea was put forward in the 1970's and 80's that it would be possible to print with conventional inks and apply a coating which would dry completely before placement on the delivery stack. This would place a dry skin over the ink, eliminating offsetting, sheet marking and the need for spray powder. The inks dry under the coating.

The advent of the 90's has made the dream a reality. It is now possible to print superior quality with conventional inks and coat the surface in order to deliver a dry, mark-free sheet at full production speeds. This is what the Super Blue products from Printing Research accomplish for you.

Printing Research, Inc.

10954 Shady Trail Dallas, Texas 75220 U.S.A.

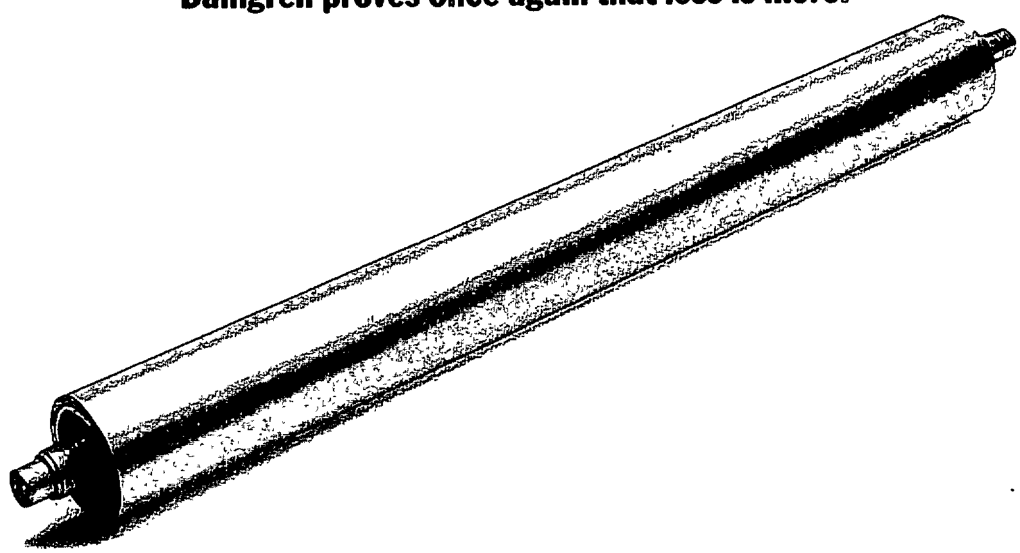
Telephone 214-353-9000
Telex 794028 Superblue dal
Fax 214-357-5847

Patented

14

In coaters, one roll is three times better than three rolls.

Dahlgren proves once again that less is more.



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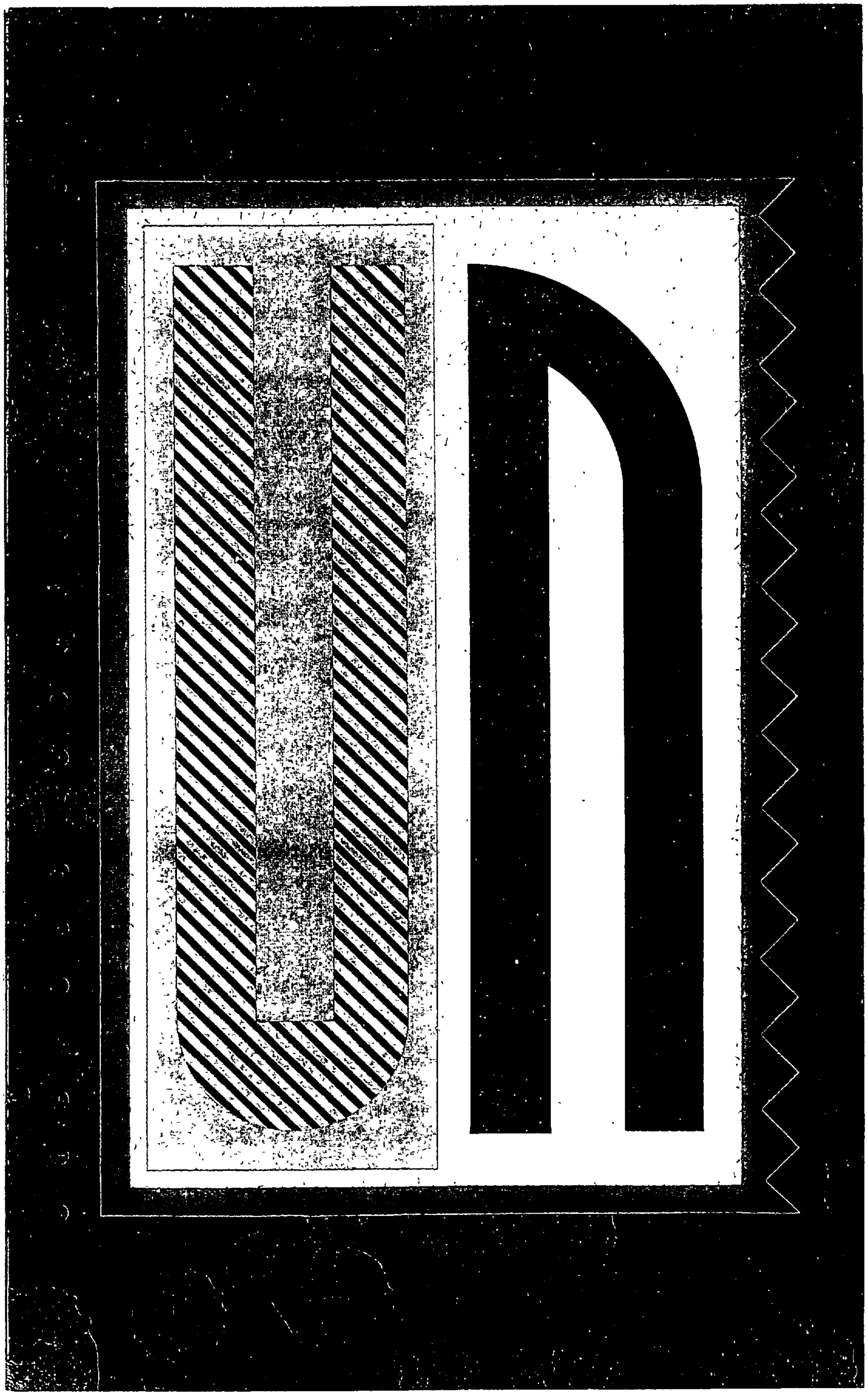
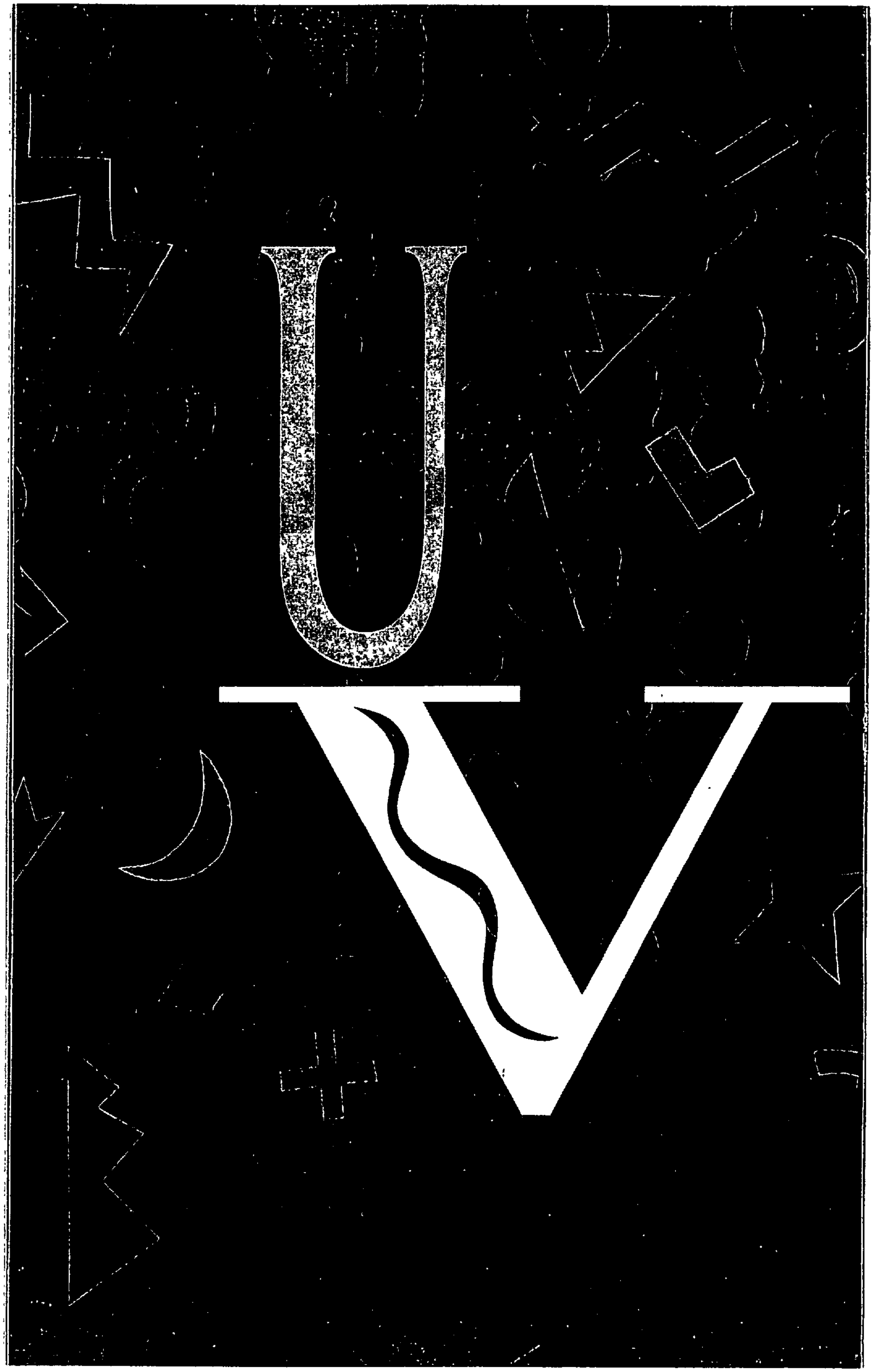


With Dahlgren's patented single–roll coater, achieving outstanding results is simpler than ever. Unlike multiple–roll coaters, the Dahlgren coater positively locks to the press to eliminate ridging, streaking, slinging and excessive orange peeling. It sets up in 5 minutes and cleans up in 10! And unlike other coaters, the Dahlgren system provides a uniform high quality coat, from start to finish. Coatweights can be adjusted at will.

Our single–roll coater provides relentless consistency for U.V., water based and specialty coatings on all popular sheet–fed presses up to 78" wide. And like all Dahlgren products, your Dahlgren coater is guaranteed to your specifications or your money back.

So call us toll–free at 1-800-527-5301 for more information today. And see how less is more with a Dahlgren.



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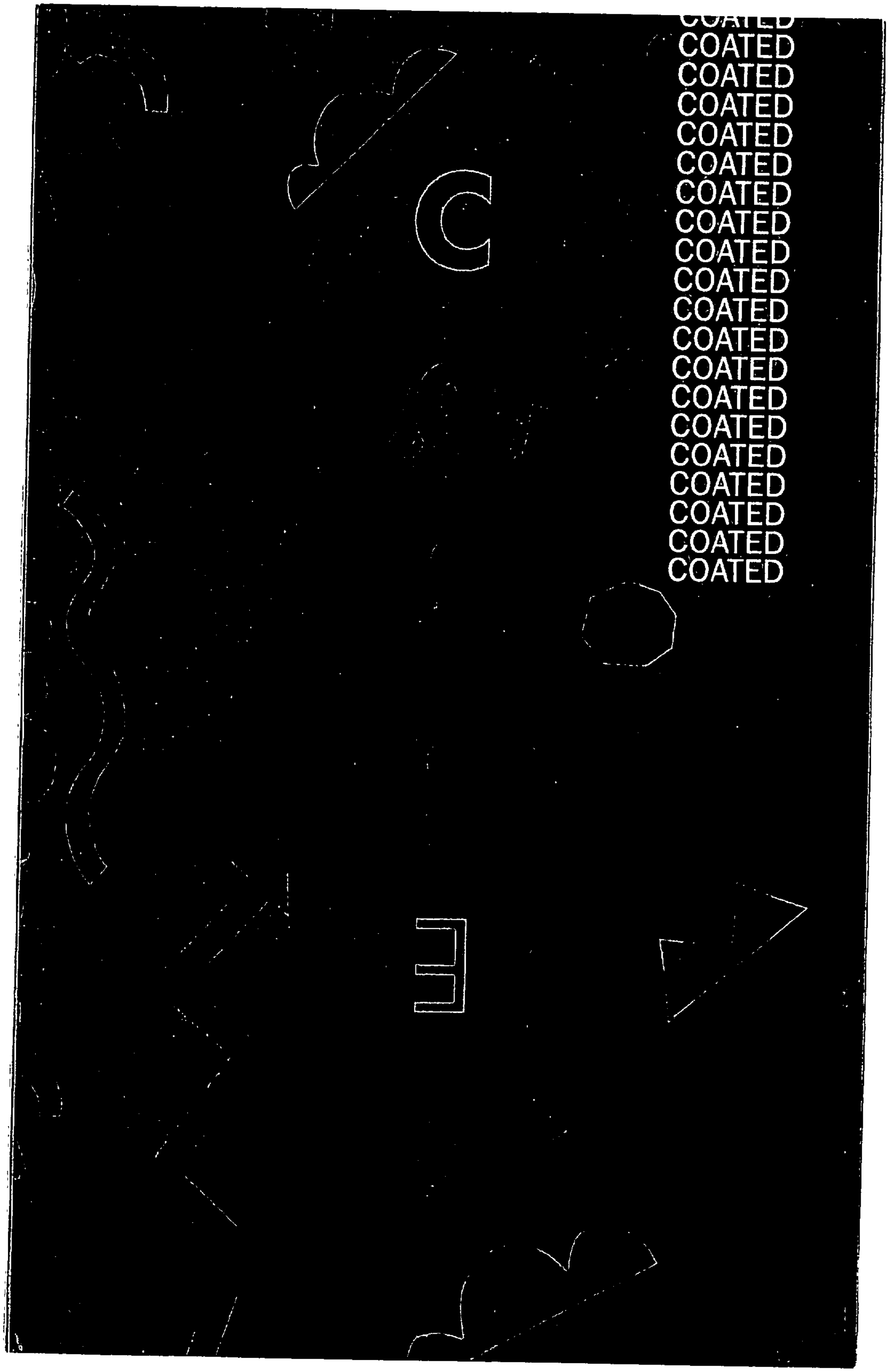
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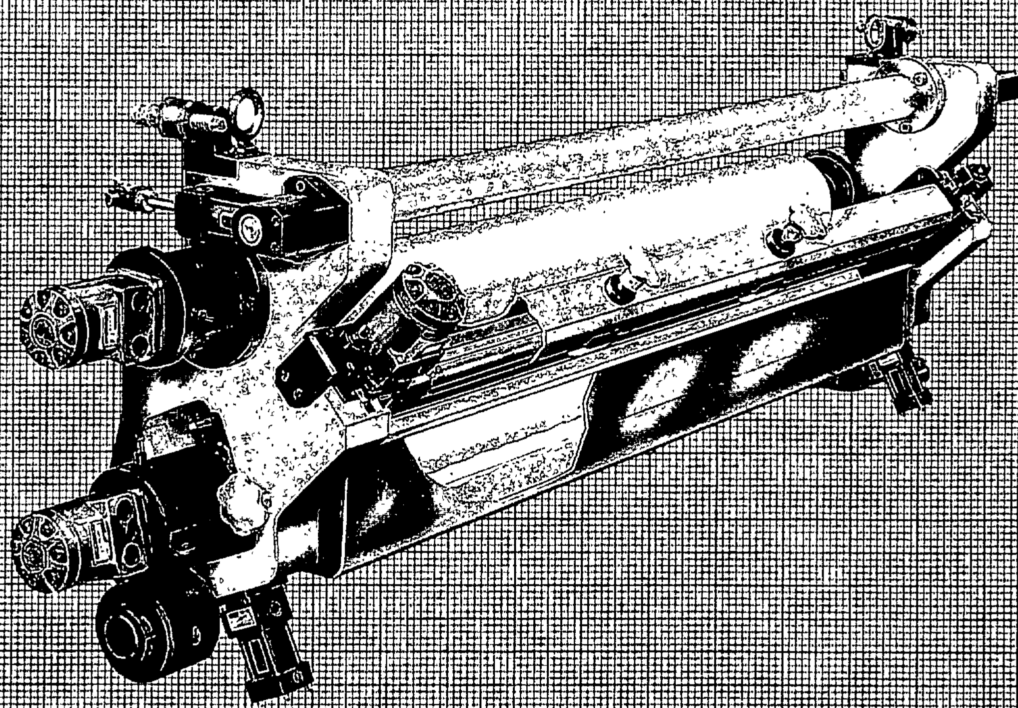
15

BLANKET COATER

For application of aqueous or coatings direct to the blanket cylinder.

IVT COLORDRY TECHNOLOGY FOR PRINTING INC



Ruggedly constructed, simple to install and operate, the IVT COLORDRY Coater saves time and money, and assures smooth, uniform application of coatings of wide viscosity range and various thicknesses. The three-roll system, an in-line retrofit bolted to the last printing unit, permits application of coatings to printed sheets in line. When coating is not required, the IVT COLORDRY Coater is easily retracted on its pillow-block type mounts, and the printing resumes its normal printing mode.

The IVT COLORDRY Blanket Coater.

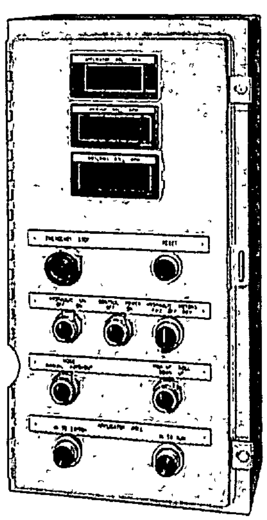
Applies water-based, ultra-violet or other suitable coating materials directly to the blanket cylinder of a sheet-fed offset press.

The IVT COLORDRY Blanket Coater can be used for either overall or spot coatings, and with a suitable drying system will eliminate the need for spray powder or press varnish. Press clean-up time is reduced, since only the blanket cylinder is used in the coating operation.

Coating thicknesses are easily varied, from a thin protective film to a thick laminate finish, by adjusting the speed and pressure of the individually-controlled, hydraulically-driven rolls.

Save time, increase productivity and lower costs.

- Fits almost all presses. *The IVT COLORDRY Blanket Coater can be installed on a variety of sheet-fed presses. If desired it can be installed on a coating station, rather than attached to a printing unit.*
- Fast installation. *Simple, bolt-on retrofit; installation time normally two days of press down-time.*
- Individual R.P.M. Indicators. *For easy set-up and control.*
- No interference with press run. *Coater can be quickly and easily retracted or removed from press when not in use.*
- Direct to blanket cylinder. *Coating is applied from the applicator roll directly onto the press blanket cylinder.*
- Variable thicknesses. *Coathing thickness can be adjusted during a run by varying coater roll speeds.*
- Even laydown. *Application direct to the blanket eliminates one split, provides greater control.*
- No roll changes. *Metering of coating is simple and effective over a wide range of applied thicknesses. No need for roll changes.*
- Compact. *The IVT COLORDRY Blanket Coater is designed to occupy the least possible space on the press.*
- Rugged. *Sturdily constructed to give dependable, lasting service.*
- Reduced clean-up time. *After coating, only the blanket cylinder requires cleaning. The ink train, dampening system and plate cylinder remain clean and ready for use.*



Control panel operates both the coater and the hydraulic power unit. Digital meters continuously show RPM readings for each of the three rolls.

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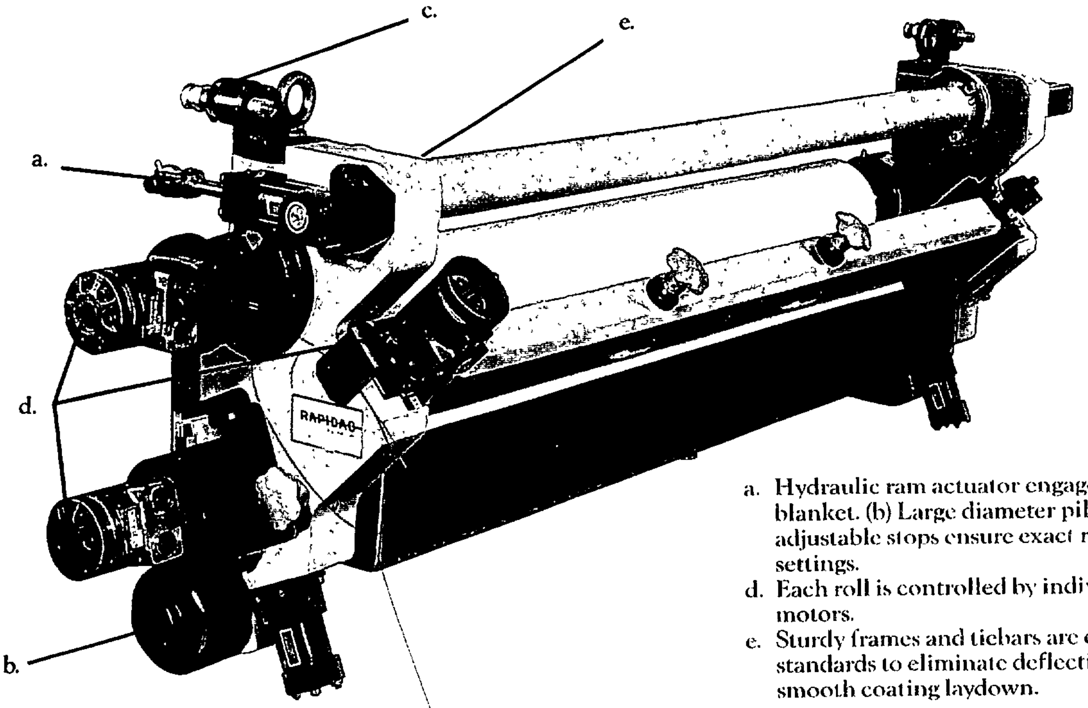
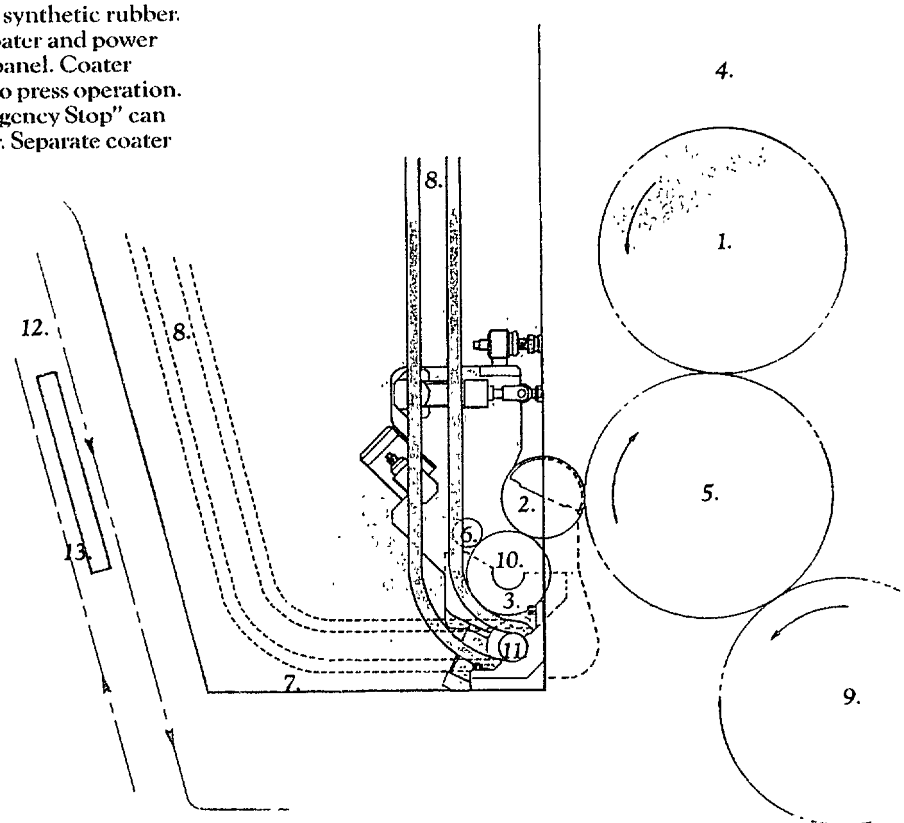


a. Hydraulic ram actuator engages coater with blanket. (b) Large diameter pillow blocks and (c) adjustable stops ensure exact repeatability of settings.
d. Each roll is controlled by individual hydraulic motors.
e. Sturdy frames and tiebars are engineered to press standards to eliminate deflection and ensure smooth coating laydown.

Specifications

- Three roll design — Metering roll is chrome. Applicator and pick up rolls are synthetic rubber.
- Single Control Panel — Both coater and power unit are controlled from single panel. Coater operation is electrically linked to press operation.
- Emergency Stop — Press "Emergency Stop" can be interlocked to include coater. Separate coater "Stop" control is provided.

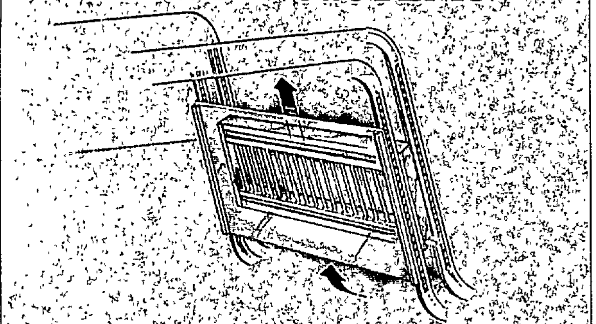
The Blanket Coater is retractable, and does not interfere with the dampening system, with fast changeover from print to coat and coat to print. The applicator metering and pick up rolls are independently driven through a hydraulic system, with the applicator being able to be run in reverse. Slinging, misting, striations, gear markings, and consequent loss of gloss, are largely eliminated. Greater flexibility in coating weights and optimum lay flat properties are achieved.



1. *Plate Cylinder*
2. *Applicator roll*
3. *Coating pan*
4. *Last press unit*
5. *Blanket cylinder*
6. *Metering roll*
7. *Rear deck*
   Retraction systems
   Impression cylinder
10. *Pic-up roll*
11. *Pillow block mounts*
12. *Press delivery*
13. *Dryer to suit aqueous or UV coatings*

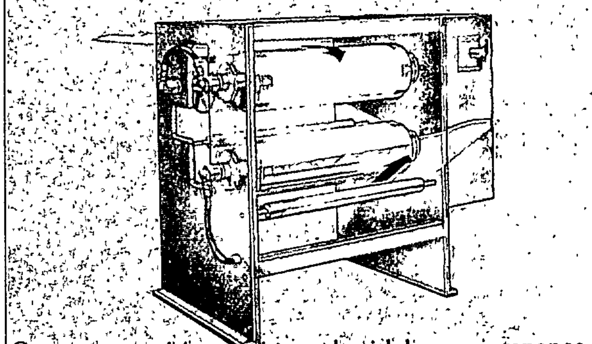
Other IVT COLORDRY products:

WATER COOLED IR DRYING SYSTEMS



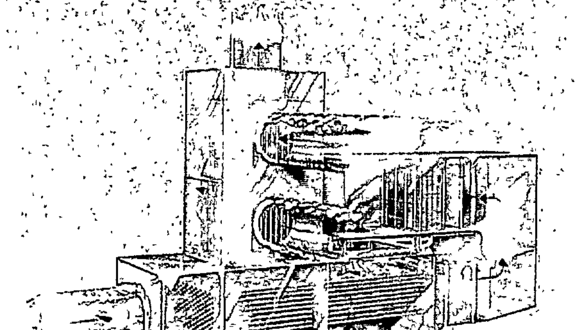
For accelerating ink drying reducing spray and/or drying of aqueous coatings.

CHILL ROLL STAND



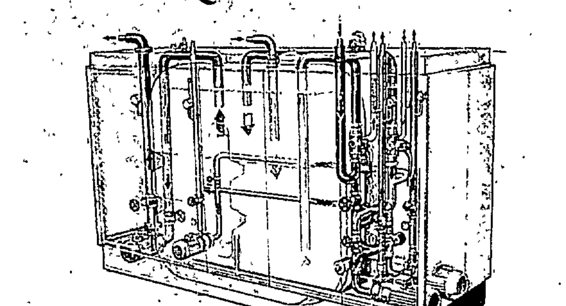
Compact, precision engineered, with low maintenance.

CATALYTIC PURIFIER



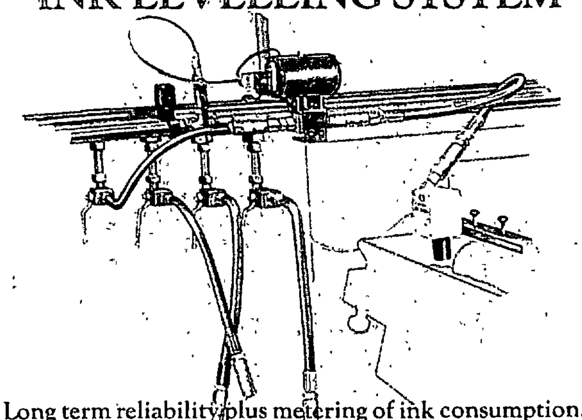
The highest standards of air purification plus the economy of heat reclamation.

PROCESS COOLING EQUIPMENT



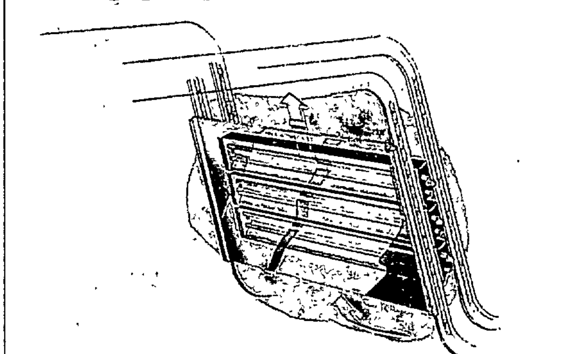
Central refrigeration systems for web presses inking, chill and dampening systems.

INK LEVELLING SYSTEM



Long term reliability plus metering of ink consumption.

'COLD' UV SYSTEMS



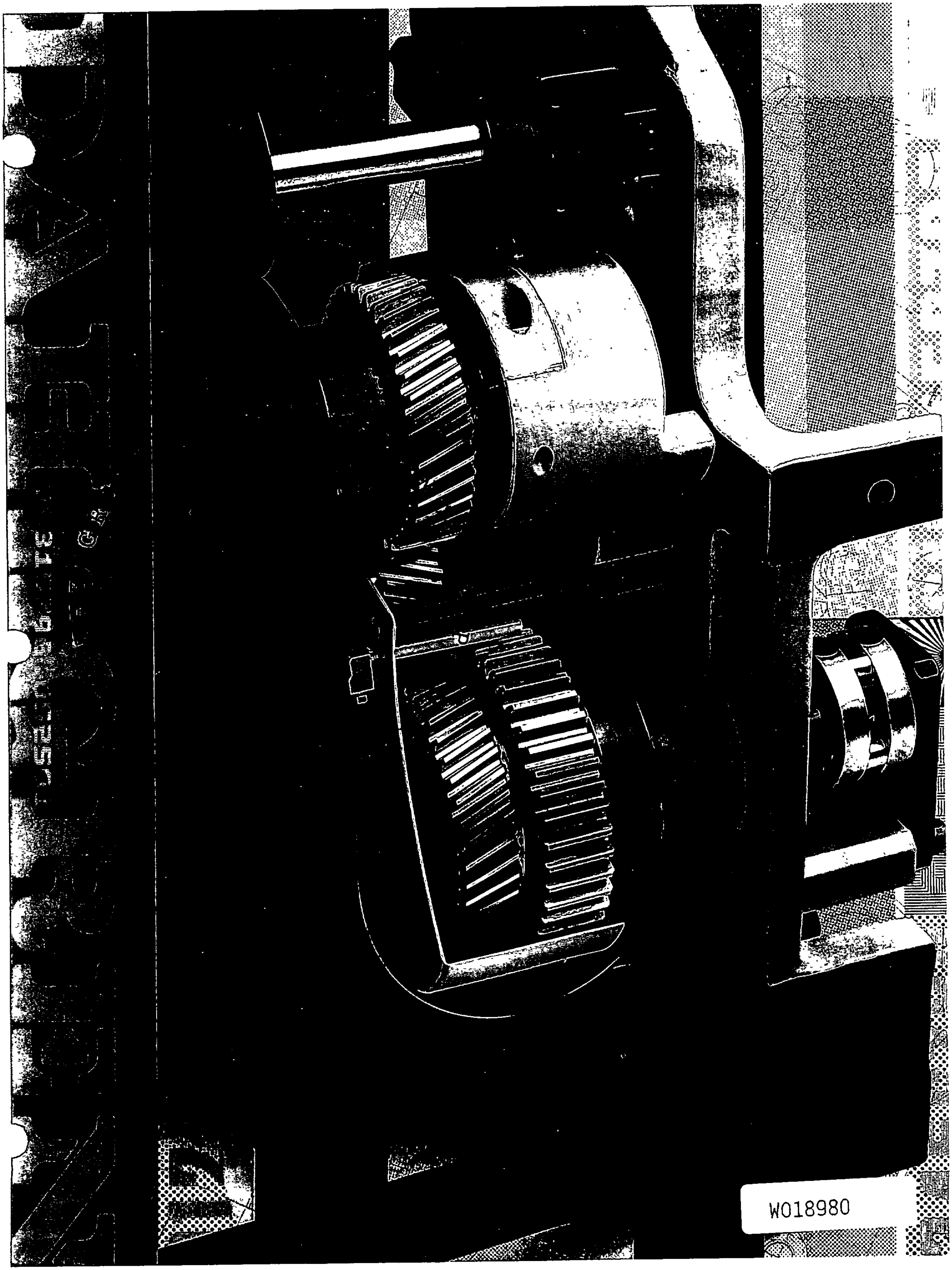
For the curing of UV inks and coatings on any substrate.

IVT COLORDRY
TECHNOLOGY FOR PRINTING INC

W018978

IVT COLORDRY INC. · 425 Post Road · Fairfield, Connecticut 06430 U.S.A. · Telephone: (203) 255-9201 · Telex: 643433

16



1400

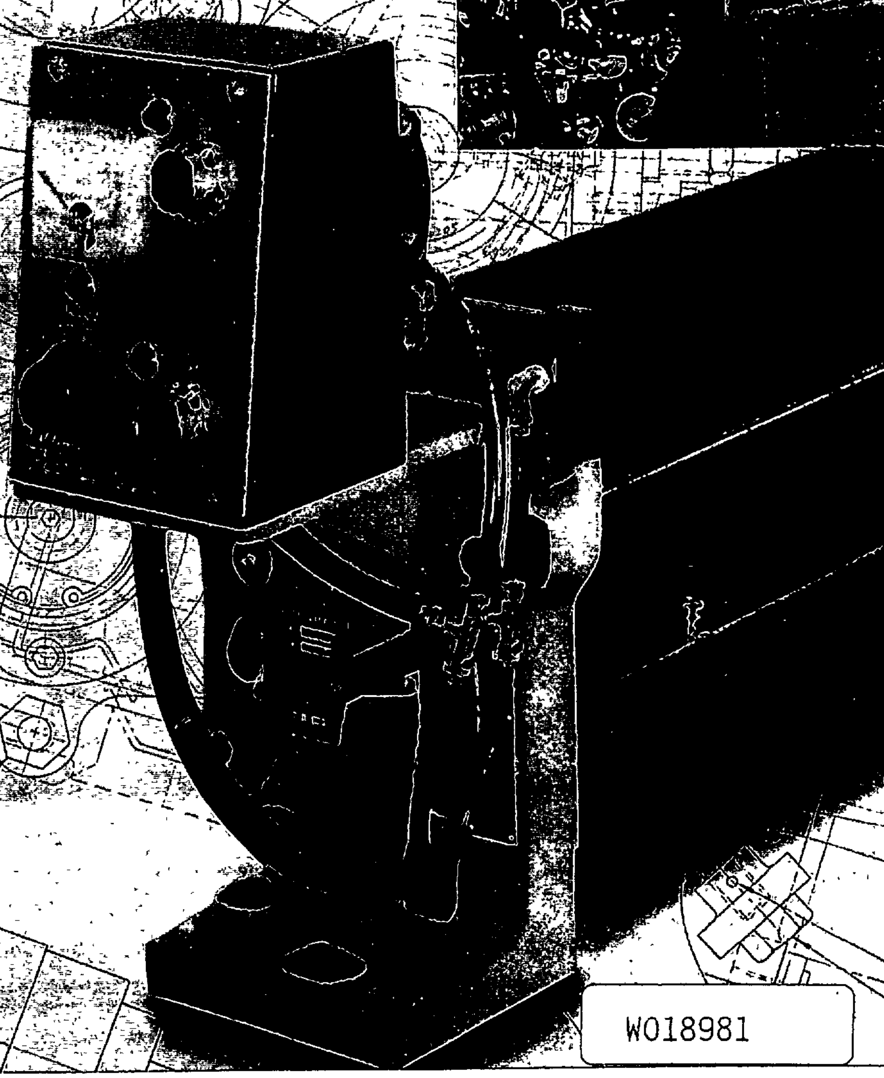
Johann Gutenberg invented the first mechanical printing press in 1439. More than 550 years later, Dahlgren is still finding ways to improve on the concept.

In 1485, Ratdolt pioneered the use of color printing using a basic stencil technique. Using Dahlgren dampeners, today's printers achieve stronger colors than ever before.

No doubt, the printing industry would still be alive had Harold Dahlgren never arrived on the scene. Yet, he did. And because of his creativity and leadership, the printing industry will never be the same.

THE ROLLS OF THE PRINTING INDUSTRY

Harold Dahlgren invented the first continuous-duty dampening system for offset presses, launching a new age of productivity and efficiency for printers everywhere. He was the first to put a coater on a press. He developed the skewed-roller system, permanently hydrophilic rollers and many other innovations that have redefined the lithographic process.



To this day, Dahlgren has more dampeners and coaters in operation than any other company worldwide. And the ideas are still rolling. Because today, as it has since 1959, The Dahlgren Company is run by thinkers – men and women whose commitment to the industry is to lead through innovation – professionals who dare to explore new directions, which result in solutions you can use to better run your printing operations.

Whatever measure of quality you apply, when you speak of coating and dampening for the printing industry, Dahlgren leads the way.

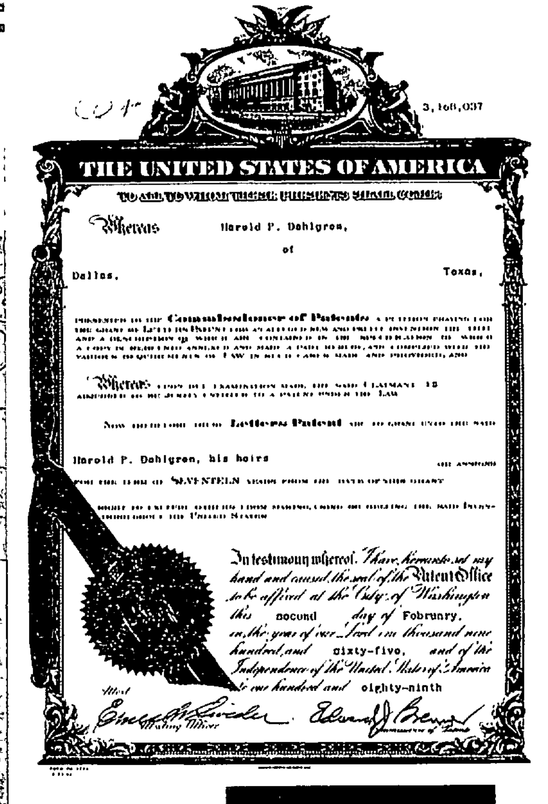
1500

Pope Alexander VI instituted the first censorship of printed books in 1501. Today's free press enjoys unparalleled options in a variety of products offered by The Dahlgren Company.

Da Carpi develops and patents the art of chiaroscuros multi-color woodcuts in 1516. Today, the Dahlgren name appears on more than 180 patents issued for coaters and dampeners worldwide.

"Fighting the conventional dampening system for seven hours can make you hostile. I know. I used to be a pressman. But I was fighting more than I was printing, and I wasn't efficient. That's what gave me the itch to come up with a better dampening system."

Hal Dahlgren


3,168,037

THE UNITED STATES OF AMERICA

Whereas Harold P. Dahlgren, of Dallas, Texas,

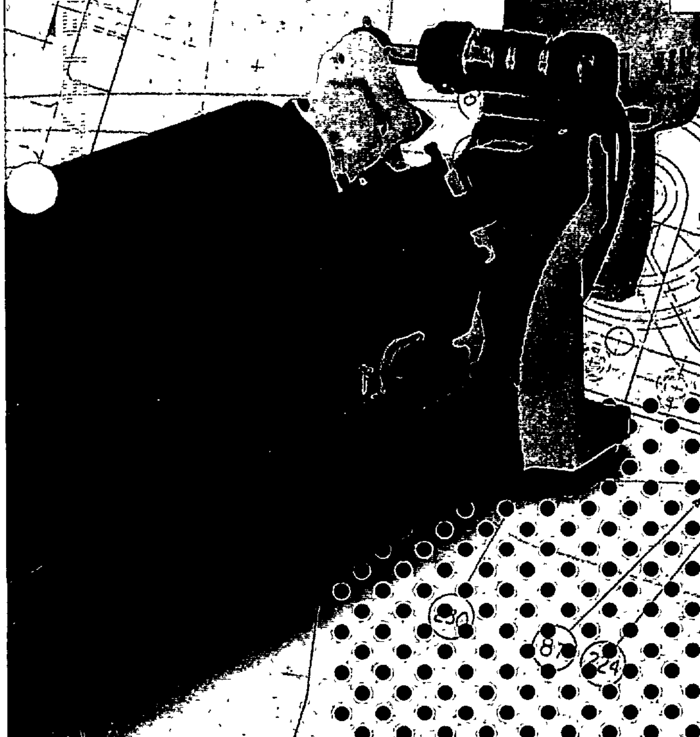
Whereas

Letters Patent

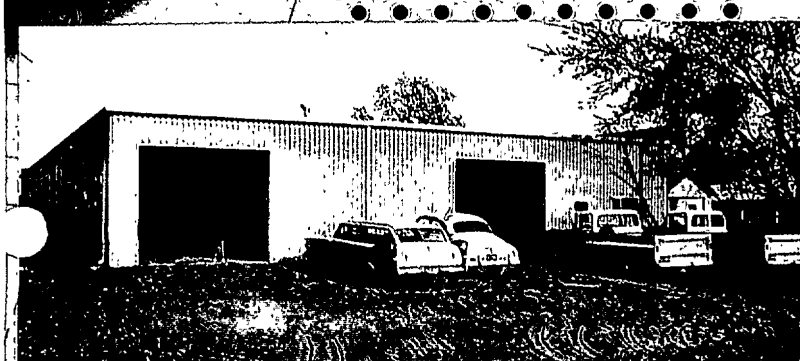
Harold P. Dahlgren, his heirs

SEVENTEEN

In testimony whereof I have hereunto set my hand and caused the seal of the Patent Office to be affixed at the City of Washington this second day of February, in the year of our Lord one thousand nine hundred and sixty-five, and of the Independence of the United States of America the one hundred and eighty-ninth



In more than 180 cases, Dahlgren has broken through conventional thinking to develop unique and novel printing concepts recognized by patent offices worldwide. This track record of innovation carries on today, as talented personnel interpret customer input into the technological breakthroughs that will drive the printing industry for years to come.



1600

A new light graceful style of illustration emerges from Callot's copperplate tests in 1630. Over the years advances such as hydrophilic rollers have resulted from Dahlgren testing

1700

Rowley secures first English patent on colored printing inks in 1772. Precise metering of the ink/water balance is what makes Dahlgren dampeners the choice for successful printers now

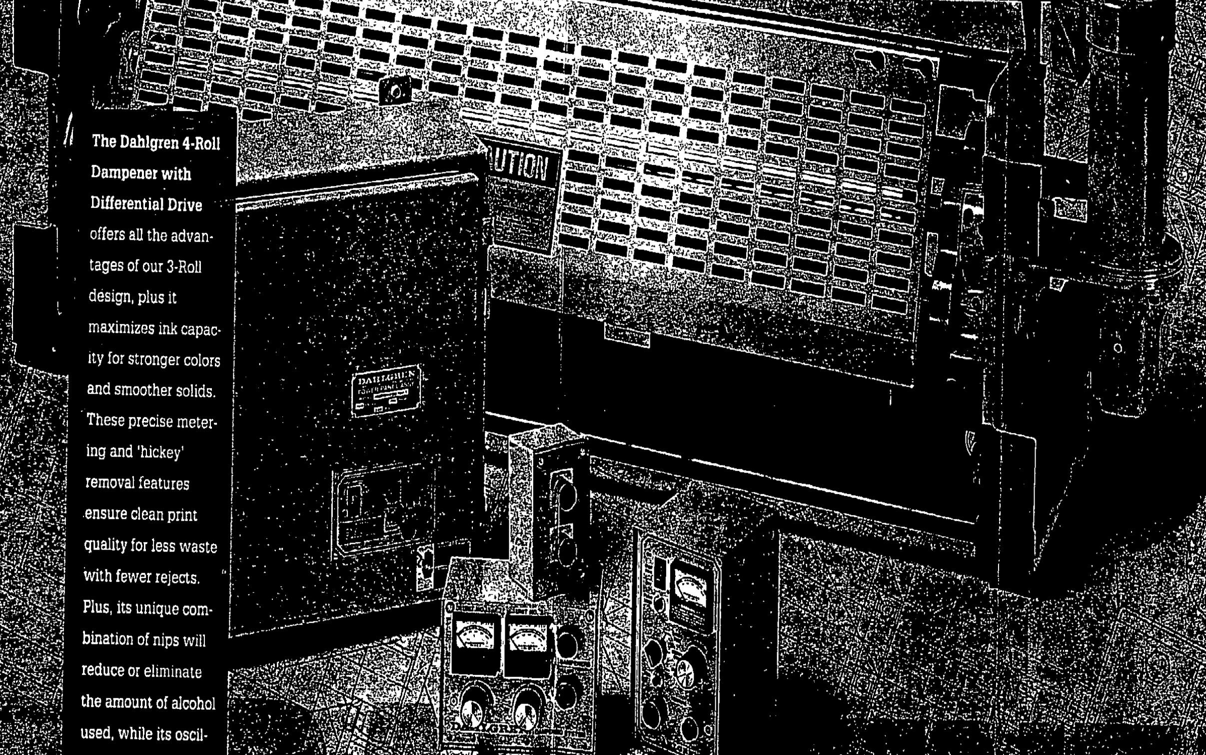
Alois Senefelder discovered lithography in 1798 based on the principle that ink and water don't mix. Years later, Dahlgren vastly improves this technology with the first continuous-duty dampening system

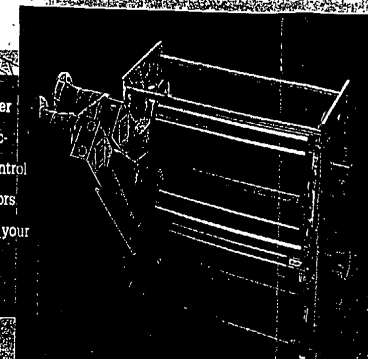
DAHLGREN DAMPENERS MAKE EVERY SHEET COUNT

Designed for sheet-fed and web presses, the Dahlgren Dampener represents the single most productive equipment investment possible for your pressroom. For less than 10% of the replacement cost of a new press, you can improve print quality, reduce downtime, have less waste and improve profitability — all while enhancing the resale value of your existing equipment.

The Dahlgren Dampener provides continuous duty operation, responds, using one control, instantly — not 50 to 100 sheets later. Half tones print sharper. Drying time is reduced. And your press prints cleaner than ever before.

With nearly 2,000 proven designs on file at the Dahlgren plant, we can provide a dampening system that suits your specific needs. From innovative design to quality manufacturing and ease of use, Dahlgren Dampeners are made to enhance your printing performance.





The Dahlgren High Speed Web Dampener provides the ultimate in enhanced productivity and performance. Precise water control eliminates emulsification for stronger colors and improved print quality. It won't limit your press speed, and it's simple to adjust and operate, as well as easy to maintain.

The Dahlgren 4-Roll Dampener with Differential Drive offers all the advantages of our 3-Roll design, plus it maximizes ink capacity for stronger colors and smoother solids. These precise metering and 'hickey' removal features ensure clean print quality for less waste with fewer rejects. Plus, its unique combination of nips will reduce or eliminate the amount of alcohol used, while its oscillating bridge roller and additional form roller dramatically reduce ghosting.

The Dahlgren 3-Roll Dampener represents the industry's first continuous-duty dampener. It's the least expensive of our line, yet it adjusts with all the ease and performs with all the durability, simplicity and quality you can expect whenever you run with a Dahlgren.

800

The "fly" and other principles for automatic press are invented by I. Adams of Rochester in 1834. In 1959, Harold Dahlgren established the principles that still drive Dahlgren today.

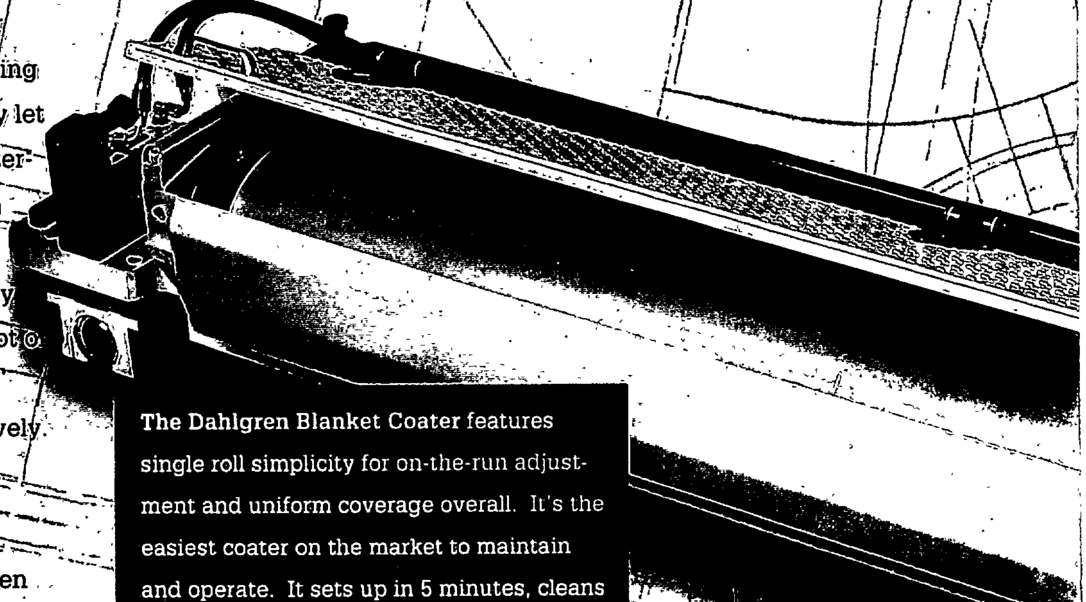
Robert Barclay, in 1875, conceives the lithographic process known as offset printing. Dahlgren supplies a full scope of coaters and dampeners for today's most popular web and sheetfed offset presses.

Three-color process printing, with half-tone cuts, is invented by Kurtz and Ives in 1892. Dahlgren-equipped presses make the entire printing process more profitable and professional.

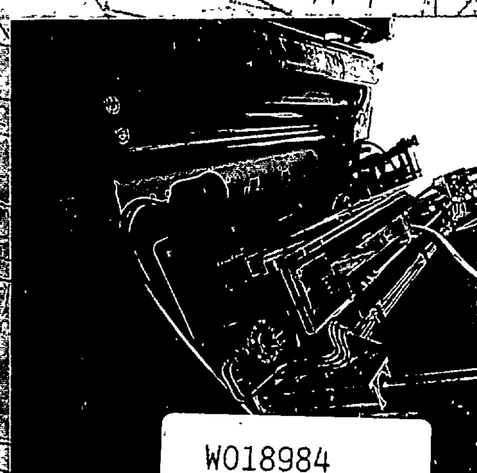
DAHLGREN COATERS ADD PROFITS TO YOUR PRESS

Getting the most out of your press is what Dahlgren coating systems are all about. They let you charge for the U.V., water-based and specialty coating jobs you or your customers might send elsewhere. They are the finest for overall, spot or pattern coating, plus, they install easily and inexpensively.

Engineered to start up and clean-up in minutes, Dahlgren coating systems are easy to use and maintain. They're compact, built to last and available in a wide variety of configurations for both web and sheet-fed presses. What's more, they incorporate a patented drying system, which helps you reduce the mess and expense of spray powder, while you cut turn-around time and lower production overhead. If you want to improve your competitive edge and offer your customers the *high gloss* and protective benefits only coating can provide, specify Dahlgren.



The Dahlgren Blanket Coater features single roll simplicity for on-the-run adjustment and uniform coverage overall. It's the easiest coater on the market to maintain and operate. It sets up in 5 minutes, cleans up in 10. And like all Dahlgren products, it can be customized for your unique application, while giving you the highest amount of coating laydown of any blanket coater. What's more, this patented coater eliminates ridging, slinging and greatly minimizes orange peeling.



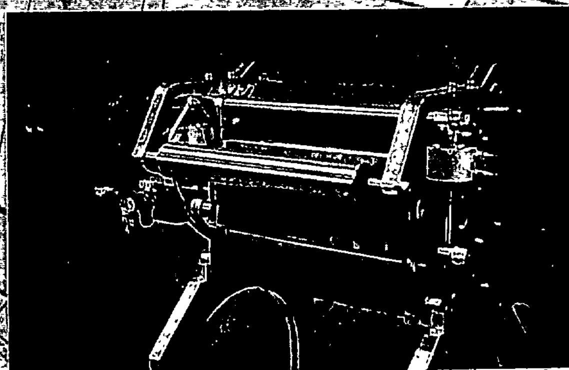
The Dahlgren LithoPlus™ Coater is designed for some of the most popular presses. It allows you to print and coat in a single pass, without sacrificing a printing unit. Plus, because it can be retracted out of the way, regular print jobs can be run easily. With the revolutionary, patented LithoPlus Coater, you save time, money and space, while improving quality and profits. Available with blanket and plate clamping systems and optional pin registration.

1900

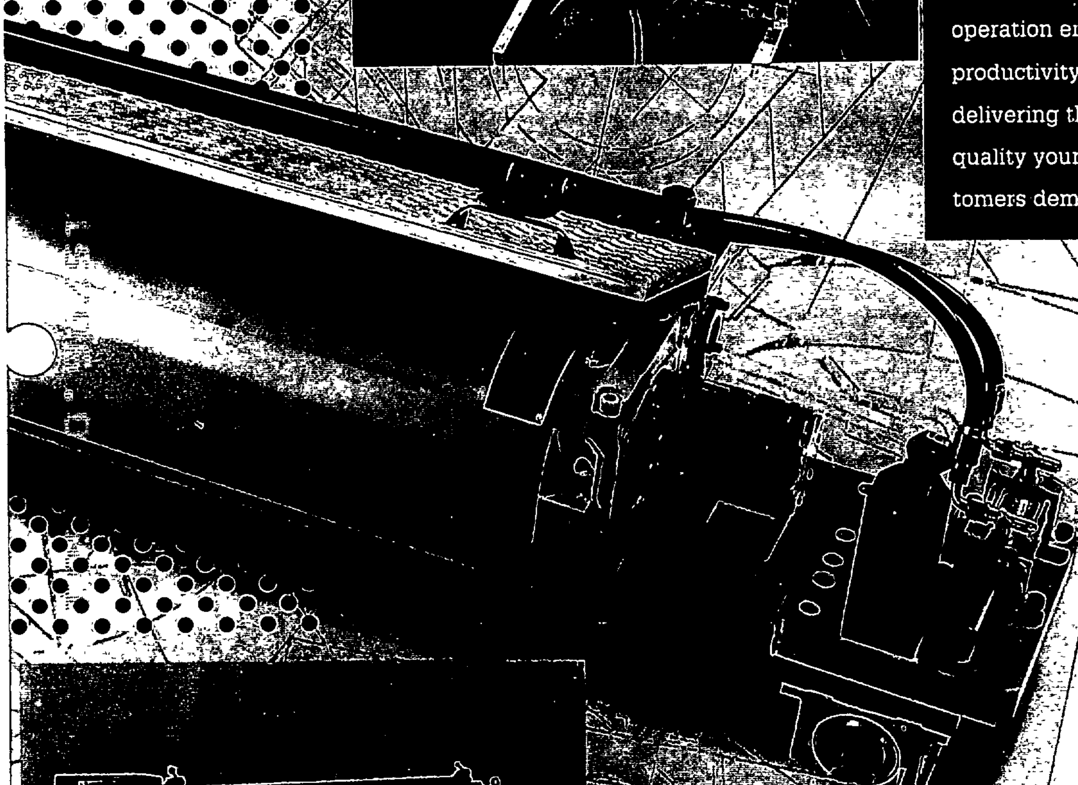
In 1910, The Freiburger Zeitung is the first newspaper to use rotary photogravure press. Dahlgren's list of "firsts" includes skewed rollers, continuous duty dampeners and in-line coating.

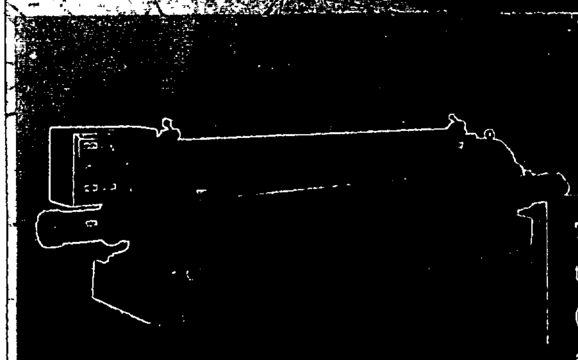
In 1956, Harold Dahlgren invented the brush dampener for web offset printing. His ideas have since revolutionized the efficiency and productivity of printers everywhere.

Throughout the 1990s, Dahlgren will continue to carry out its tradition of quality, service and competitive excellence. For the greatest performance in printing, turn to Dahlgren.



The Dahlgren Web Coater allows you to apply U.V., catalytic or aqueous coatings to the web. It's versatile and compact. It easily fits inline. And its simple operation enhances productivity, while delivering the coating quality your customers demand.





The Dahlgren Coater/Dampener, the industry's first inline coater (1972), converts from a dampener to a coater in a matter of minutes. Also available with differential drive, our coater/dampeners offer the visual appeal of coated sheets, with the efficiency and clarity only Dahlgren can provide.

W018985

No one offers a broader line of coaters and dampeners than Dahlgren. So it's no secret, we also offer the accessories you need to achieve even greater results. Our people are constantly working to improve the performance of today's printing technology. And with each revolution, we reinforce our leadership position.

The Dahlgren Ghost Chaser provides a smoother, more uniform ink laydown for less ghosting and streaking, with improved color and reduced waste.

Dahlgren UV/IR Water-Cooled Drying Systems protect your press from heat, while curing or drying ink and coatings on virtually any substrate.

DAHLGREN IMPROVES YOUR IMAGE

As a custom engineering firm, Dahlgren combines the finest craftsmanship with the latest technology — computer-aided design, numeric and computer-numeric controlled manufacturing systems — to provide responsive, one-of-a-kind manufacturing capabilities for your specialized needs. We stock thousands of parts, maintain on-line inventory systems and provide prompt shipping schedules to ensure your ultimate satisfaction. In effect, we are your full-service resource for everything from engineering to manufacturing to installation and training. At Dahlgren, you get it all.

Dahlgren Coater and Dampening Circulation Systems are designed to save space, and provide optimum and efficient control of fountain solutions and/or coatings to keep your presses running at their absolute peak efficiency.

Put Dahlgren Ingenuity To Work For You. With more than 180 patents issued to our credit, and more than 70,000 proven coating and dampening systems in operation worldwide, Dahlgren is without question the leader in the industry.

Based in Carrollton, Texas, Dahlgren USA represents the full manufacturing, engineering, service, sales and installation team you need to improve your printing performance. Our people can work directly with you to custom-engineer any system that answers your needs exactly. And our factory-trained service technicians provide the installation and training necessary to get your system up and running fast. We guarantee your satisfaction. We welcome your suggestions. And we invite you to discover the quality, efficiency and performance that has made Dahlgren the most respected name in printing today.

DAHLGREN®

P.O. Box 115140
Carrollton, TX 75011

(214)245-0035
1-800-527-5301
Fax (214) 245-0768

Coating Guide

Front & Back Covers have been both Aqueous and U.V. coated

Pages 2 - 3 no coating

Pages 4 - 5 Aqueous coating only

Pages 6 - 7 U.V. coating only

This brochure was aqueous and U.V. coated on a Heidelberg Speedmaster using a Dahlgren LithoPlus™ Coating System.

W018986

17

Increase Profit and Expand Your Market with Dahlgren's Retrofit Coaters

Ask Ariel Schmidt, president of Clinton, MA-based Atlantic Graphic Services (AGS) what he thinks about the patented new LithoPlus coater from Dahlgren, and he'll tell you: "The LithoPlus has given us an edge. By allowing us to print and coat inline, it has enabled us to deliver a better-looking and better-feeling product in the same amount of time we normally used to print."

As the only coater in production that allows you to add coating to your press, without losing that unit's ability to print and coat at the same time, the LithoPlus is making a believer out of many printers.

AGS is just one example. Facing tough economic times, the New England printer needed to find new ways of maintaining a profitable business. Two seemingly counter-solutions emerged: lower overhead; and expand services. At first, it seemed an impossible task. But as the company explored its options, the LithoPlus coater proved worthy. By allowing AGS to print and coat inline, the company was able to save time and cost, and avoid loss of control when farming-out coating jobs.

Says Ariel: "Despite the economy, we're able to run two shifts on our Mitsubishi six-color press. We can deliver the jobs one or two days sooner, and the cost to coat is less than a penny per press sheet. At that rate, we're more than able to cover our capital investment and make a profit, while giving our customer a higher-quality product."

AGS coats virtually 100 percent of the output from its Mitsubishi press. AGS has now installed a second LithoPlus on its two-color Heidelberg Speedmaster. Sales are up 18 percent, and profits have risen 22 percent.

Says Schmidt: "The feel of the printed sheet and the gloss make a positive impression on customers. Because of coating, our rejection rate has dropped to almost zero. We've also saved on freight and the hassle of dealing with outside specialty suppliers."

Currently available for the Heidelberg Speedmaster and Mitsubishi sheetfed presses, the LithoPlus is equipped with plate clamps for precision spot coating. Each installation is engineered to customer specifications.

Dahlgren also offers the industry's top-selling blanket coater. This single anilox roll coater features the same coating head as the LithoPlus system. No other coater can lay down more coating with more uniformity. Set-up takes only five minutes, clean-up only ten. Slinging, streaking and orange-peeling are eliminated. And with more than 200 installations worldwide, the Dahlgren blanket coater is a proven performer.

Web coaters for overall coating in one- or two-sided jobs are also available from Dahlgren. These allow aqueous or UV coating to be applied inline on webs up to 66 inches, at speeds up to 2,000 fpm.

Meanwhile, sheetfed presses can still benefit from Dahlgren's traditional coater/dampener technology. Dahlgren's new differential drive coater/dampener combines the advantages of the new differential drive dampener — eliminating hickeys, ghosting and alcohol — with Dahlgren's coating system.

Dahlgren engineers have also converted one- and two-color presses into productive off-line coating systems, working with such models as Harris, OMSCA, Miller and Miehle/Roland. Its technical staff can help with virtually any unique coating system, from two-roll coaters to plate coaters. And as with all Dahlgren equipment, each product is covered by Dahlgren's guarantee that if the unit doesn't perform to customer satisfaction, Dahlgren will remove it and provide a full refund.

So if you'd like to improve the overall quality and profitability of your printing business, consider the words of Ariel Schmidt: "When it comes to service, Dahlgren is it."

For more information, call 800-527-5301, write Dahlgren USA, 1725 Sandy Lake Rd., Carrollton, TX 75006.

David Linton adjusts AGS' Dahlgren LithoPlus coater.

DAHLGREN'S COATER CHALLENGE: $1,000,000.00

Dahlgren invites other coater manufacturers to put up or shut up.

At Dahlgren, we're so sure our patented Blanket Coater is the best in-line sheet-fed blanket coater on the market today, we'll pay any manufacturer $1,000,000 if they can prove their coater lays down more coating, more uniformly, at production speeds, with less trouble than ours. Just run the same blankets, coating, and stock under the same conditions, and if Dahlgren doesn't come out on top, we'll pay $1,000,000 on the spot. It can't be done.

What does that mean if you're in the market for a new press or retrofit coater? It means that if any coater or press manufacturer tells you their coater is better than the Dahlgren Blanket Coater, they're not telling you the truth. Here's why.

"The Dahlgren Blanket Coater combines advanced, patented, proprietary technology with more than 20 years of coating experience to bring you the best coater money can buy. Period."

We've seen it happen too many times. Printers are sold a bill of goods by a manufacturer who claims their coating unit or tower will perform better, and that an extended delivery is a necessity. Months later, when the cost in lower production speeds, wasted stock, rejects and lost time mounts, these same printers retrofit with a Dahlgren Blanket Coater. Suddenly, they get results. Why?

Dahlgren was the first company to put a coater in line on a press. Since then, we've perfected the process using a simple, easy-to-use design that features an anilox roll and doctor blade configuration for maximum coverage and uniformity. This single-roll design makes the Dahlgren Blanket Coater simpler and more reliable than other, more complex designs. No other coater even comes close.

"Dahlgren's unique, rugged, single-roll design eliminates the problems of orange-peel, slinging, and ridging common to multiple roller coaters."

The magic behind the Dahlgren Blanket Coater is simple. Our single, anilox roll coating head uniformly carries more coating to the blanket and sheet than any combination of rubber or chrome surfaces can possibly carry. That's because each anilox roll cell "cups" the coating, carrying more and losing less.

Once the coating is applied to the roll, a special doctor blade uniformly removes excess coating from the roll surface and returns it to the nip for replenishing. The coating is then applied to the blanket from the roll. Competitive coaters return any excess coating to a roller train, causing non-uniformity, ridging, slinging, and fading from gripper to tail.

Our coater is hydraulically locked to the press to ensure rigidity and eliminate the chattering effect you may find on other coaters. What's more, you can run at full production speeds for maximum productivity. One million dollars says you can't do better than that.

"Quality always pays. Which is why the Dahlgren Blanket Coater is the best investment you can make in a coating unit. And you can take that to the bank."

Whether you're running U.V., water-base, blister seal, or specialty coatings, you won't find a better way to apply it in-line than with a Dahlgren Blanket Coater. No matter what our competitors would like you to believe, remember Dahlgren:

- Lowers your cost,
- Improves your production,
- Can eliminate spray powder
- Increases your customer satisfaction,
- And offers a money-back guarantee.

If you're a manufacturer with a tall tale to tell, put up or shut up. Take the Dahlgren $1,000,000.00 challenge. If you're in the market for a coater, don't take a chance. Buy a Dahlgren. One roll outshines them all.

P.O. Box 115140 Carrollton, TX 75011
(214)245-0035 Fax (214) 245-0768

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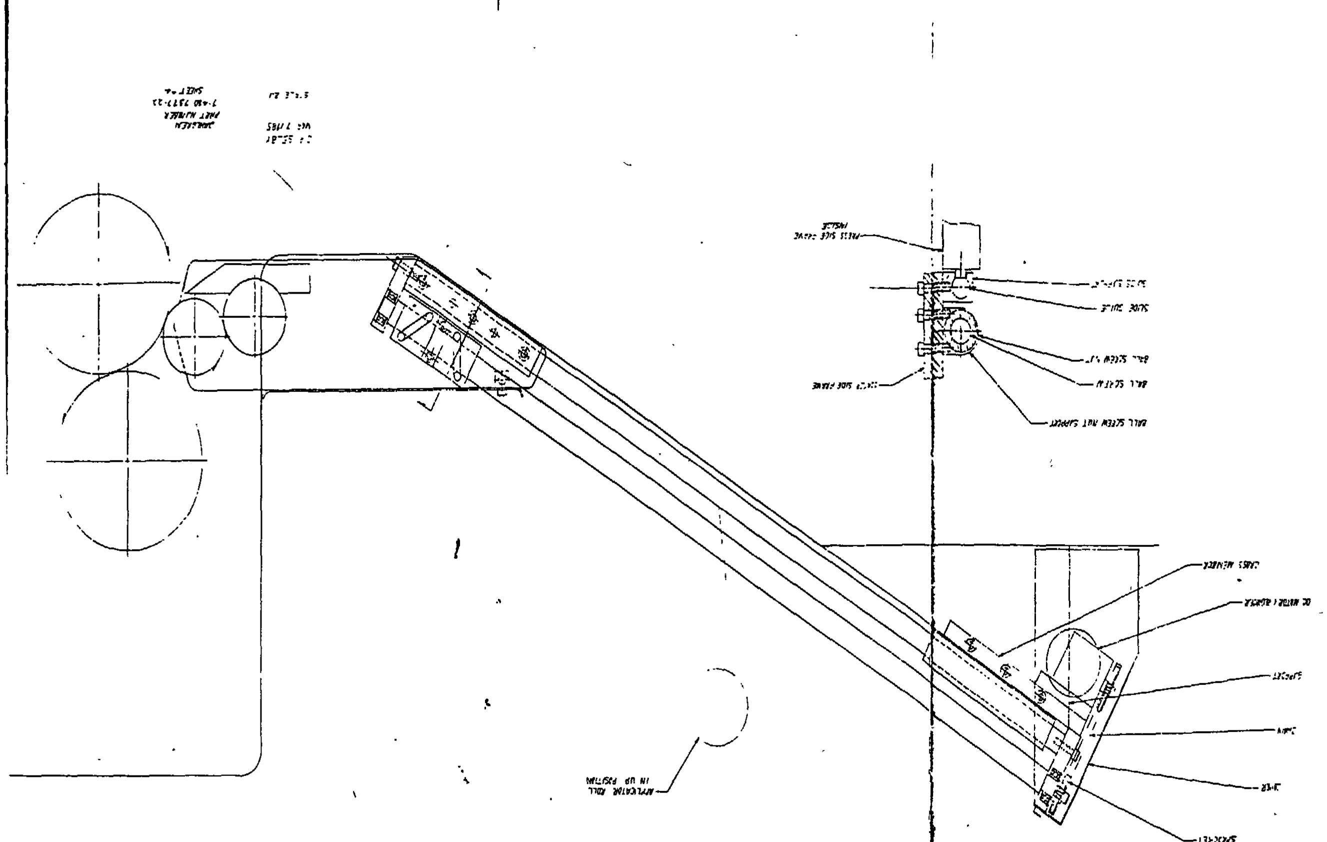
W018994



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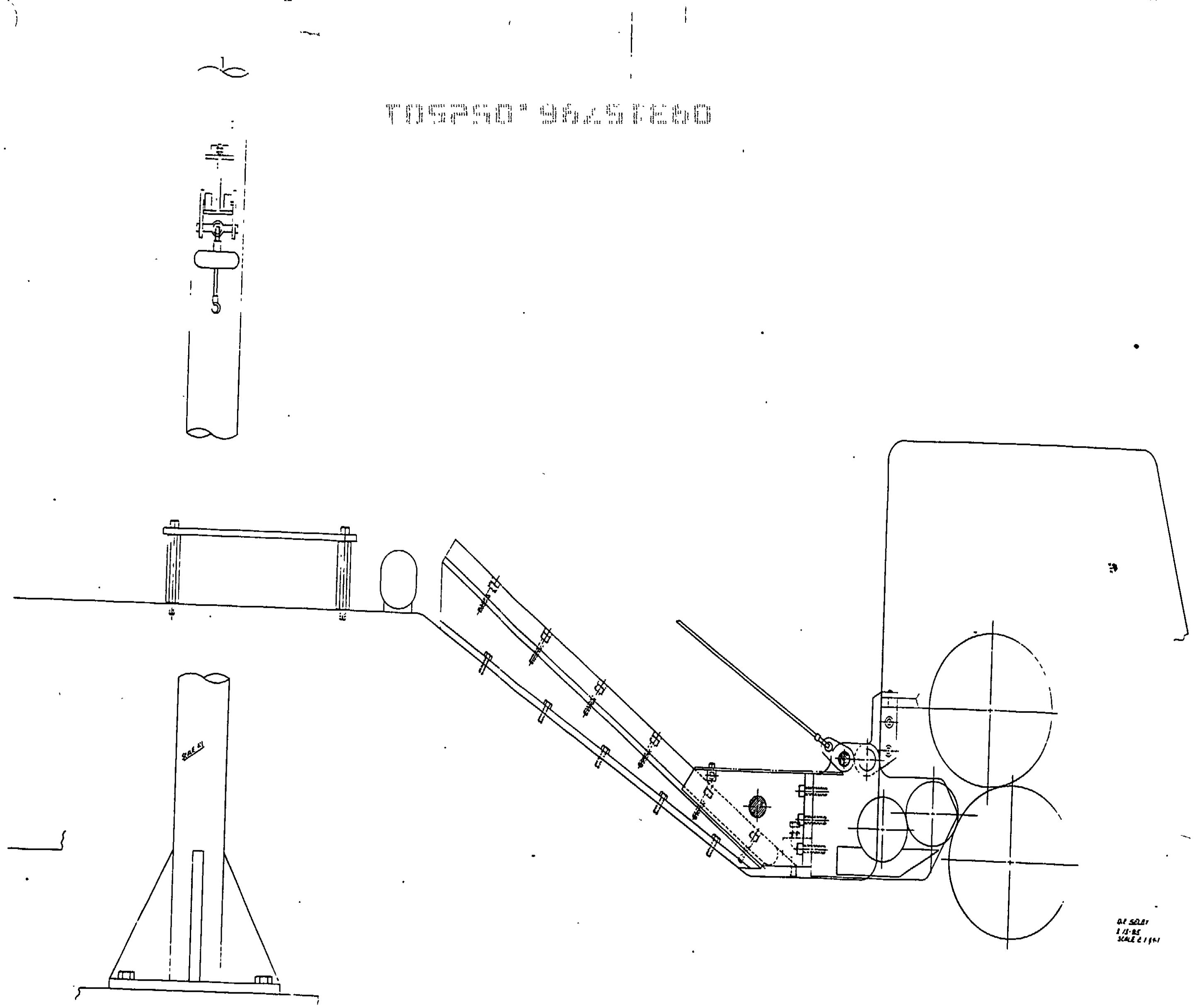

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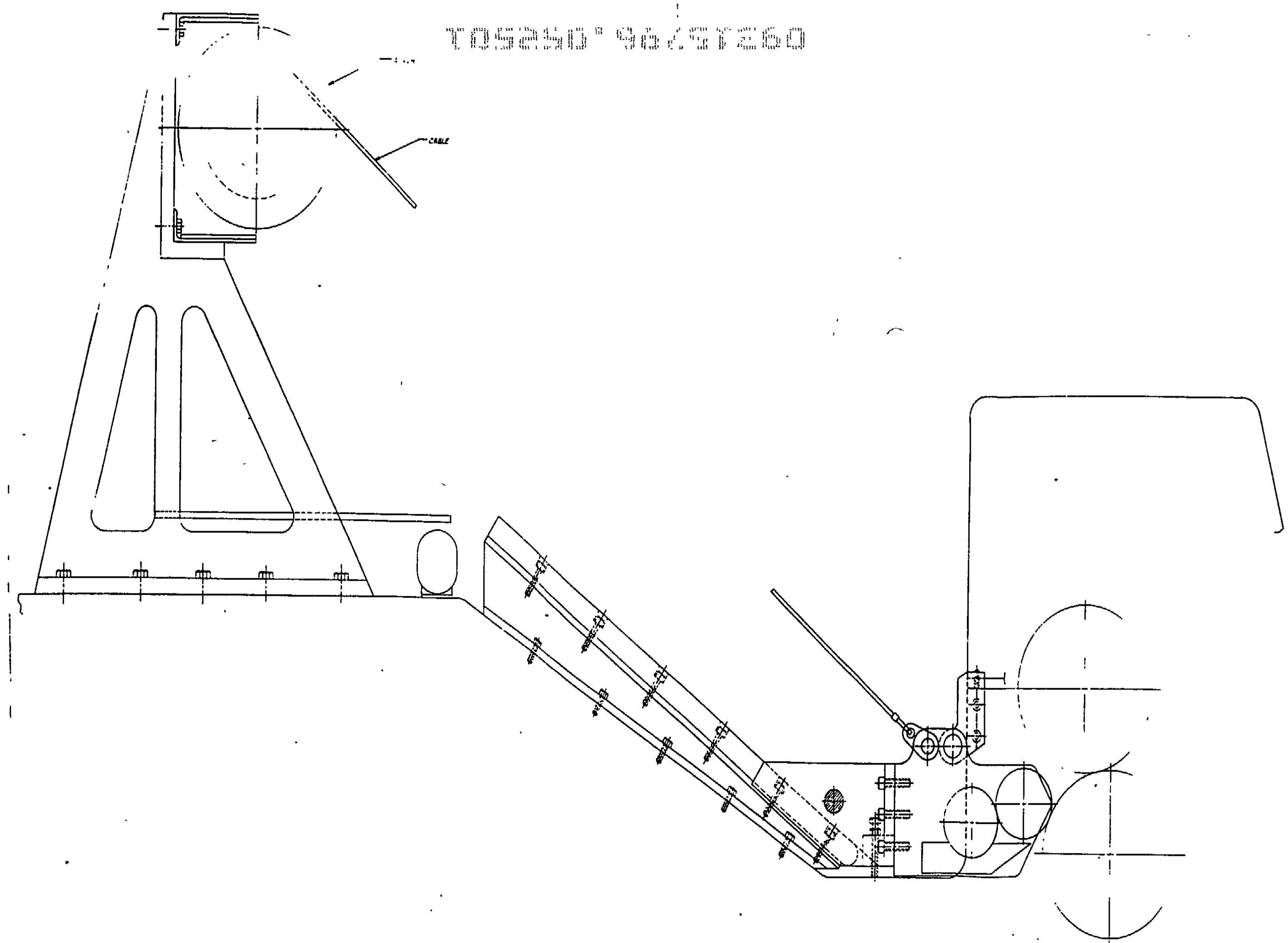

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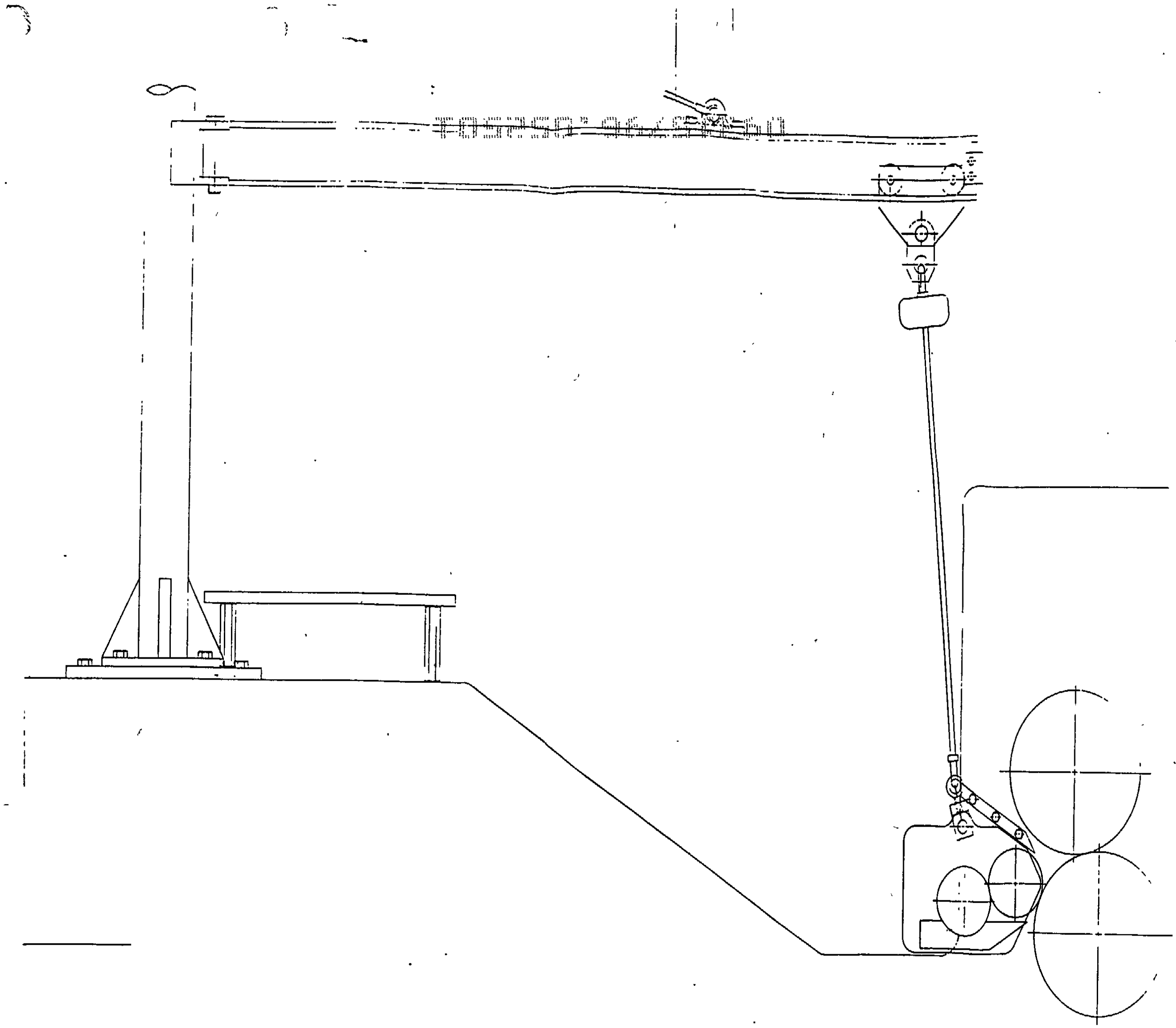

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Removeable Alternates

0. None (Stationary)

① { 1. Cherry Picker (Floor mtd.)
2. " " (Press mtd.)

② { 3. Overhead Rail + Hoist (Floor mtd.)
4. " " + " (Press mtd.)

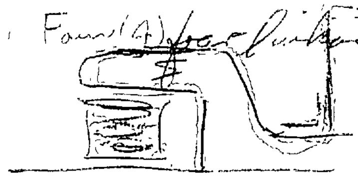
③ { 5. Vertical Hoist (lift) (~~Ceiling~~ ~~mtd. or~~ Floor, or Press mtd.)

4 { 6 Rotating Arms (Ferris Wheel)

5 { 7. Horizontal + Side Movement (w/ Cart)

6 { 8. Rack back @ angle

7 { 9. Four (4) ~~bar linkage~~ (call John G for pictures) (612) 735-3588
~~[illegible]~~



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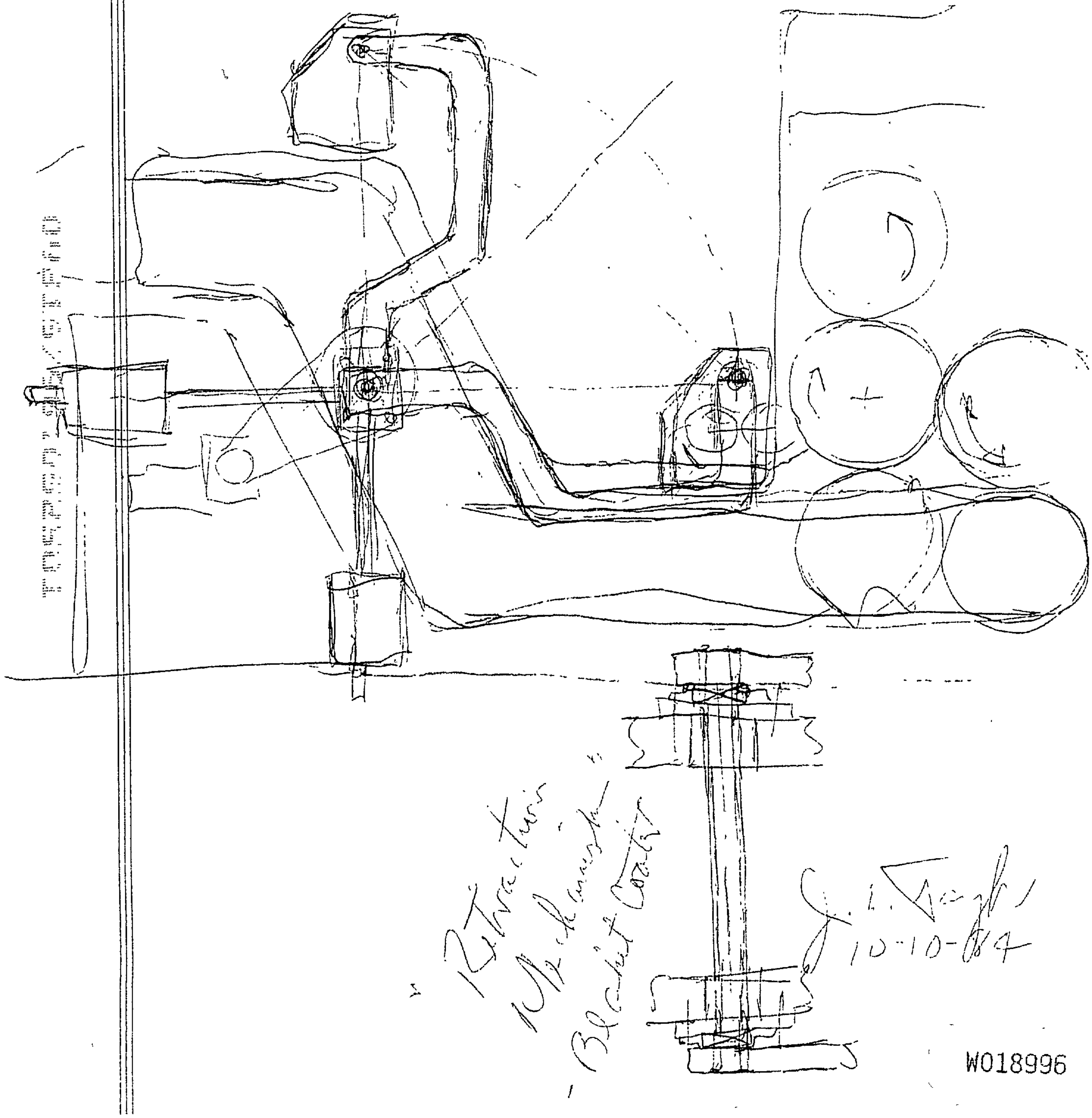
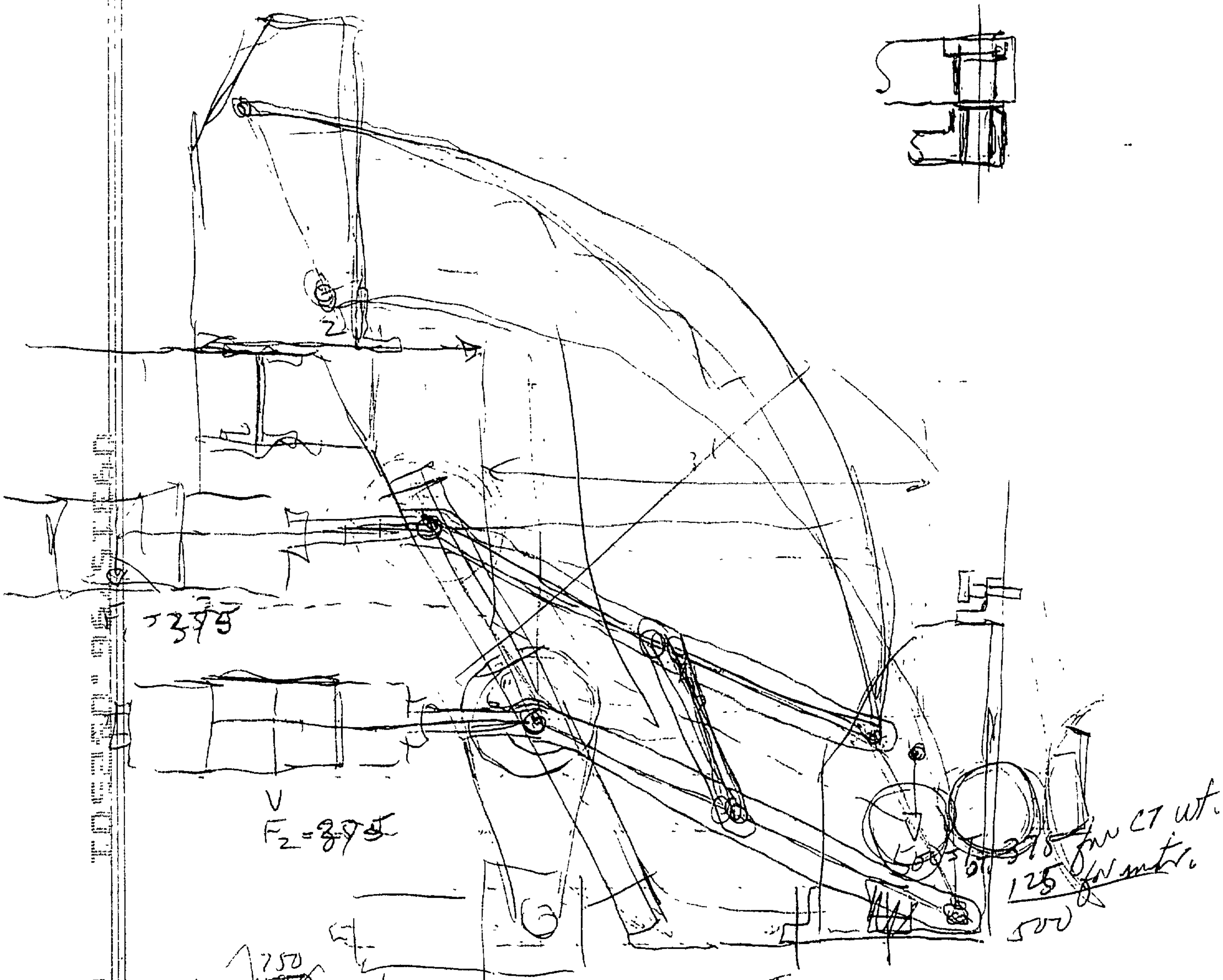

Retraction
Mechanism
Blanket Carrier
10-10-84

Tues. @ 7:00 PM
channel 13
"Science of Sailing"
Visit Inland's & Lunch



$T = Fr$, $F = \frac{T}{r} = \frac{750}{1/2} = 1500$

$T = Fr$, $T = 3(375) = 1125$ ft·#

~~$F_1 + F_2 = 500$, $F_1 = F_2 = 250$~~

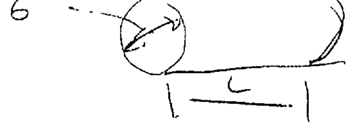
$T = Fr$, $F = \frac{T}{r} = \frac{1125}{2} = \cancel{750}\#\ 588\#$

$F = F_1 + F_2 = \cancel{750}\#\ 588\#$, $F_1 = F_2 = \cancel{375}\#\ 294\#$

V = 1/3 Rev. in 1/3 min
= 1 " " 1 min
= 1 RPMs

$P = \frac{TN}{5250} = \frac{1500(1)}{5250} = .28$

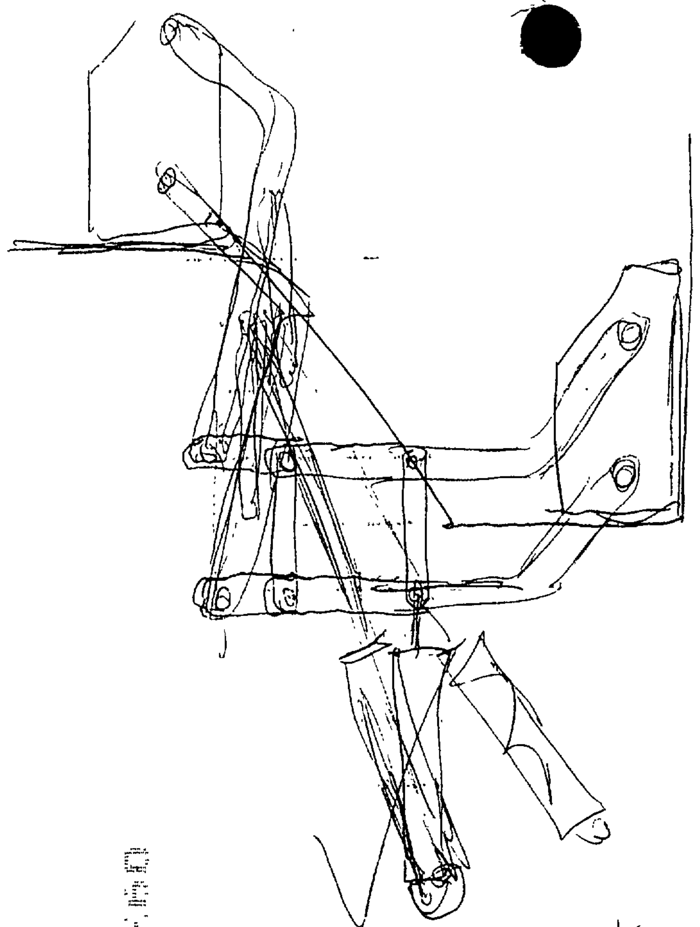
use 1/3 to 1/4 HP

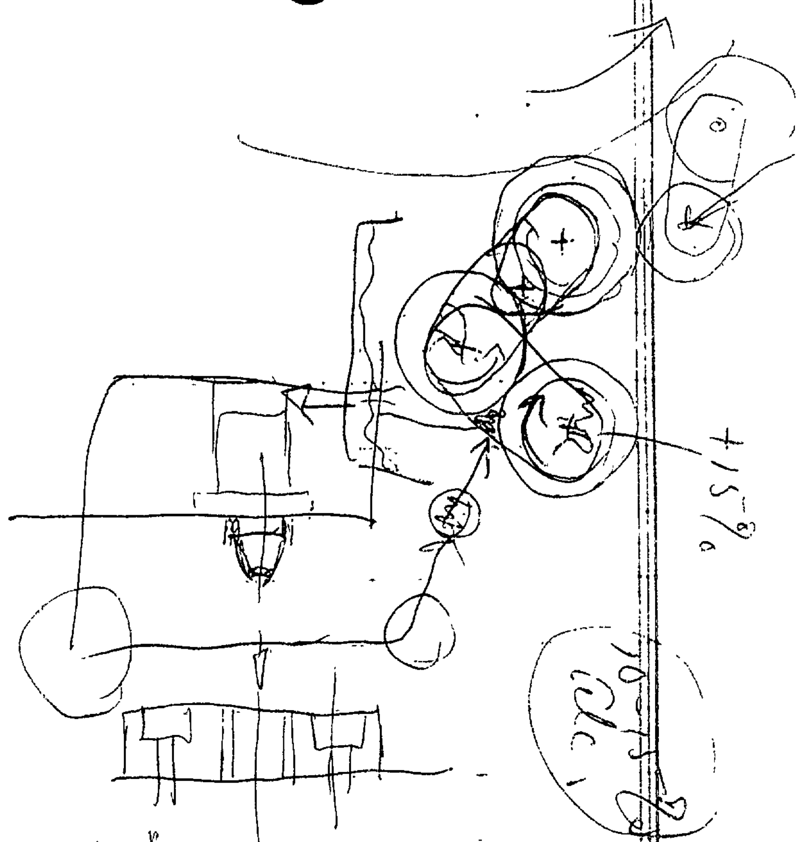


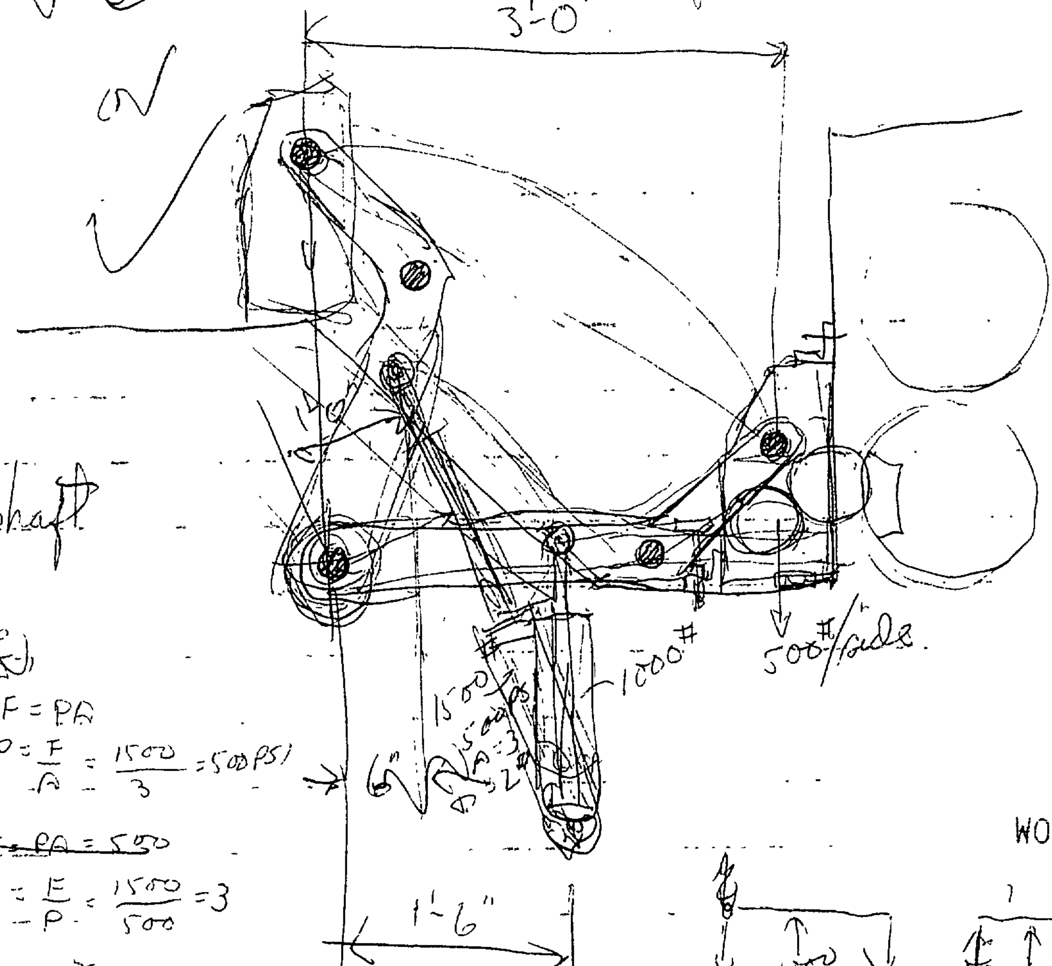
$V = .8(6)^2 L = .8(36)L = 29L$ in^3

$w = vd$, $294 = 29L(.3)$, $L = \frac{294}{29(.3)} = 34$"

W018997







= Crossshaft

F = PA

$P = \frac{F}{A} = \frac{1500}{3} = 500\ PSI$

~~F = PA = 500~~

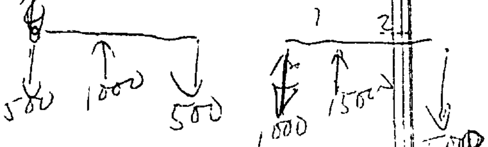
$A = \frac{F}{P} = \frac{1500}{500} = 3$

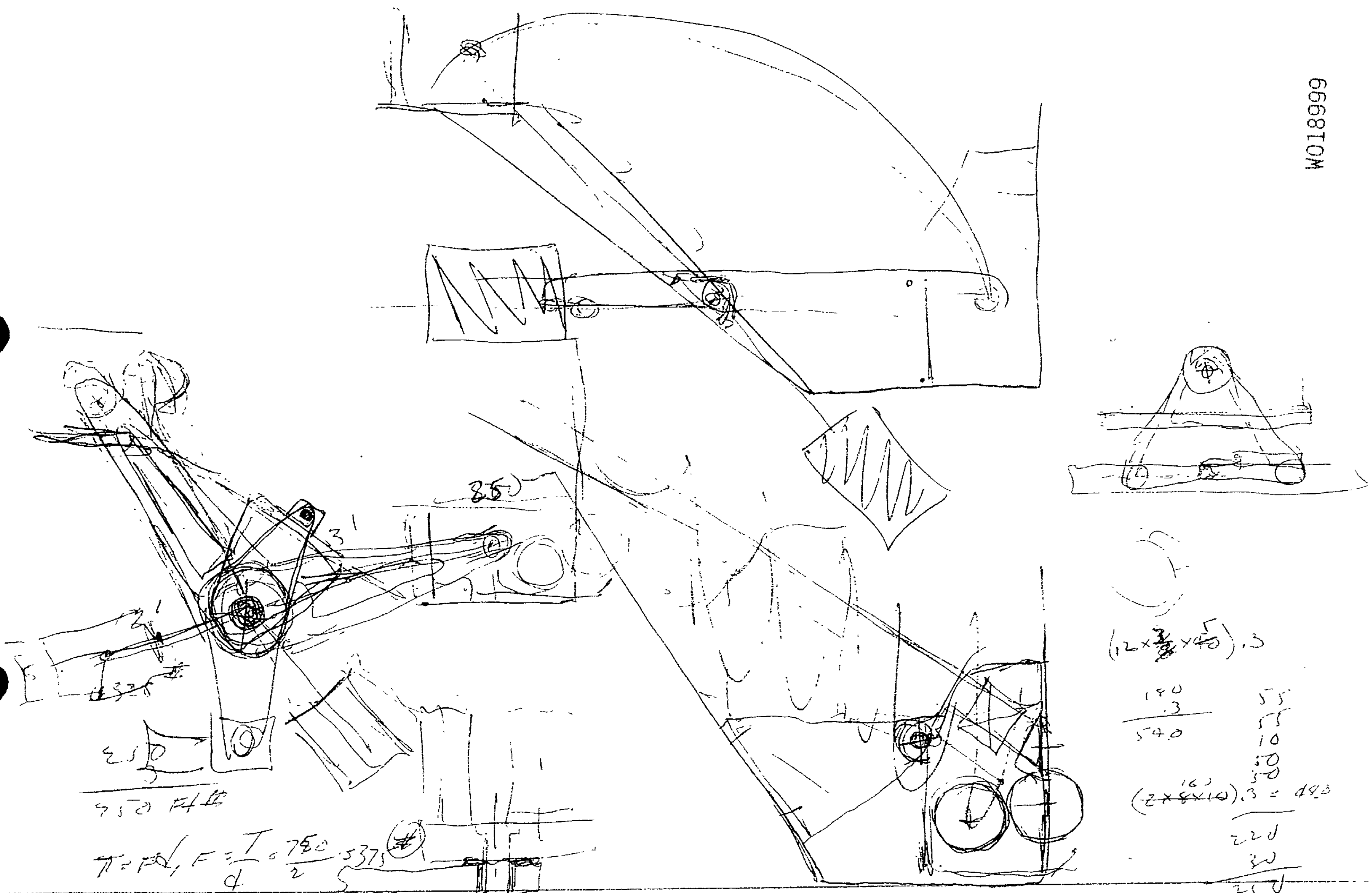
$A = \pi r^2$

$r = \sqrt{\frac{A}{\pi}} = \sqrt{\frac{3}{3}} = \sqrt{1} = 1$

D = 2"

W018998





$(12 \times \tfrac{3}{8} \times \tfrac{5}{40}) .3$

$\frac{180 \times .3}{54.0}$

$(\cancel{2 \times 8 \times 10}) .3 = 48.0$

220
30
210

250
3
750 Ft lb

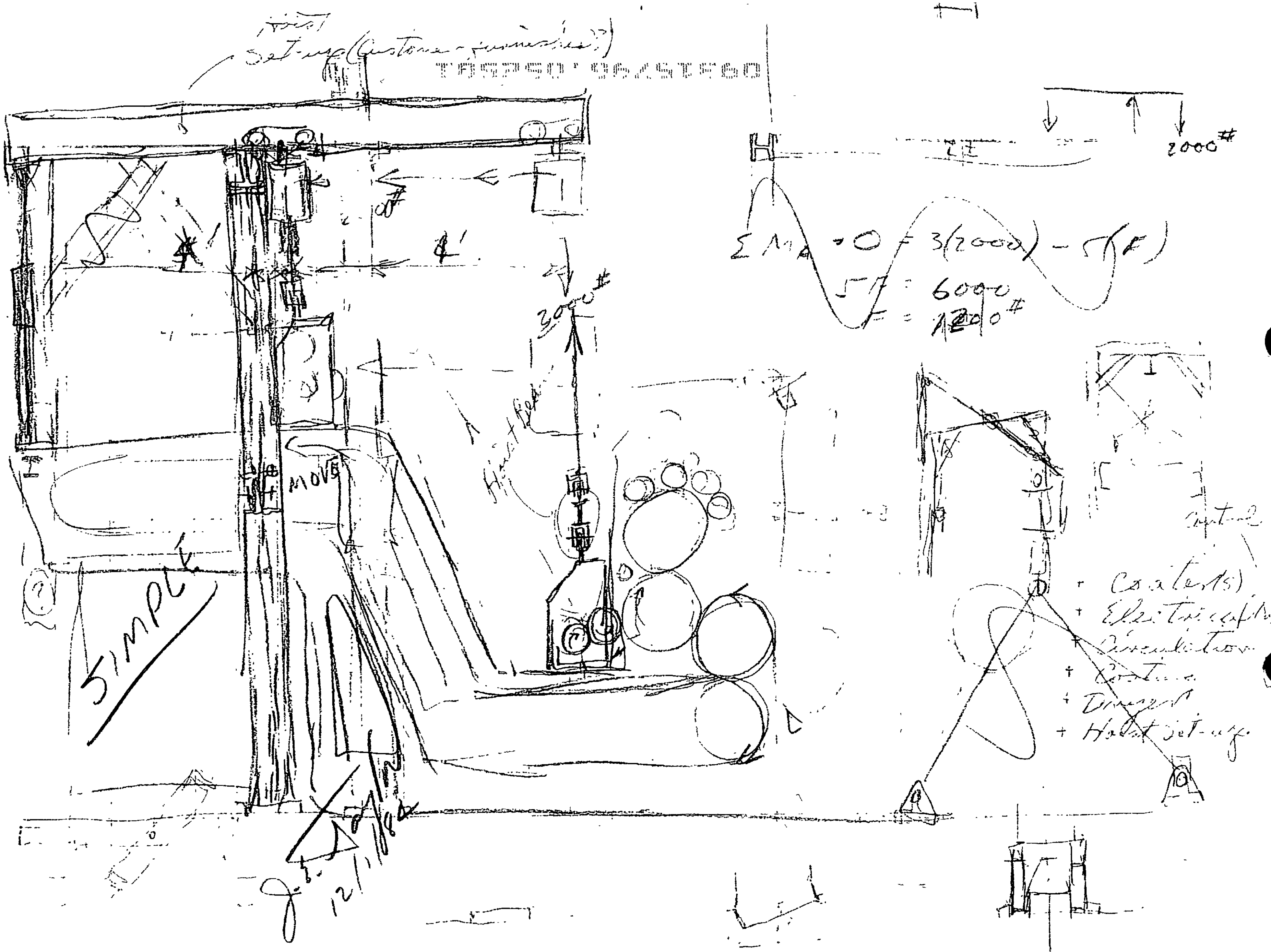
$T = Fd,\ F = \frac{T}{d} = \frac{750}{2} = 375$

$5(6) \times 20 (.7) = .8(720) .7 = 920(.56)$

$\frac{56}{4520}$
$\frac{3100}{353.20}$

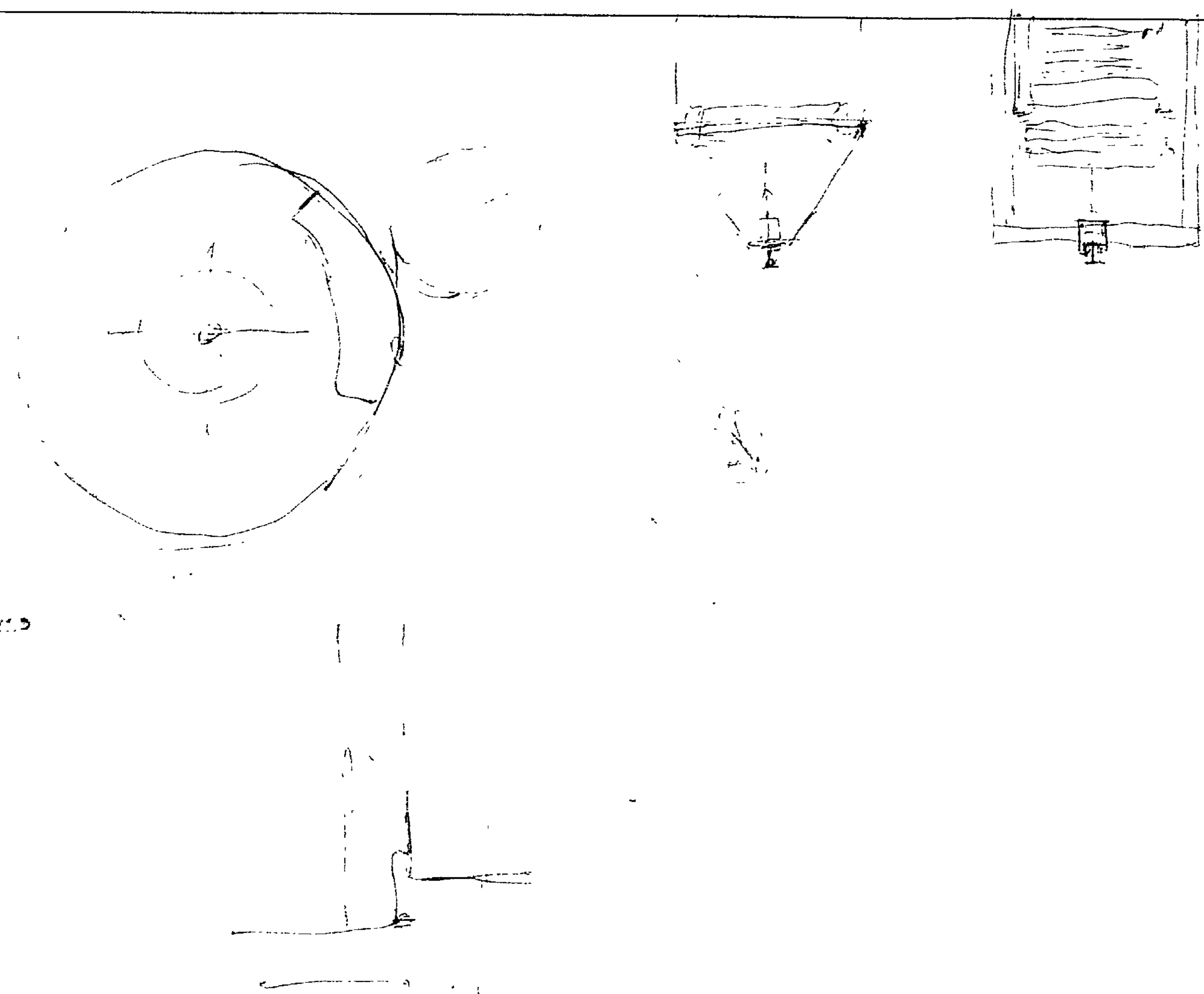
09316796.052601

W018999



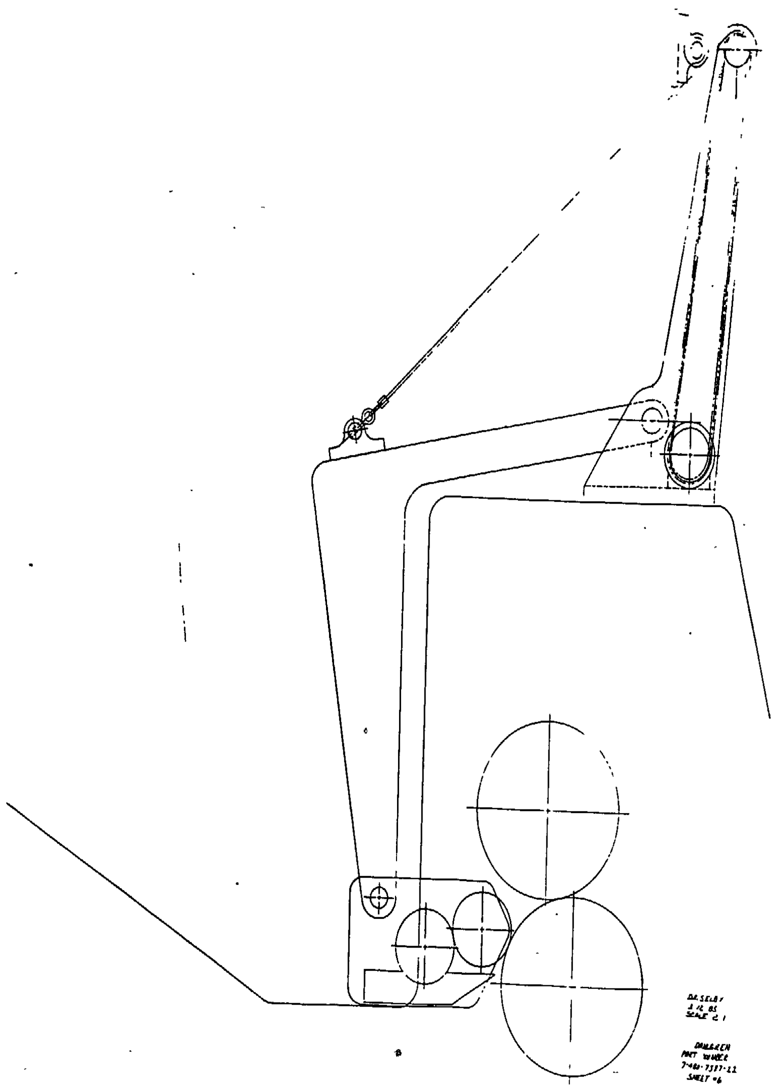
2000#
3000#
4'
MOVE
SIMPLE
$\Sigma M_A = 0 = 3(2000) - 5(F)$
$5F = 6000$
$F = 1200\#$
+ Coal (ets)
+ Hoist set-up

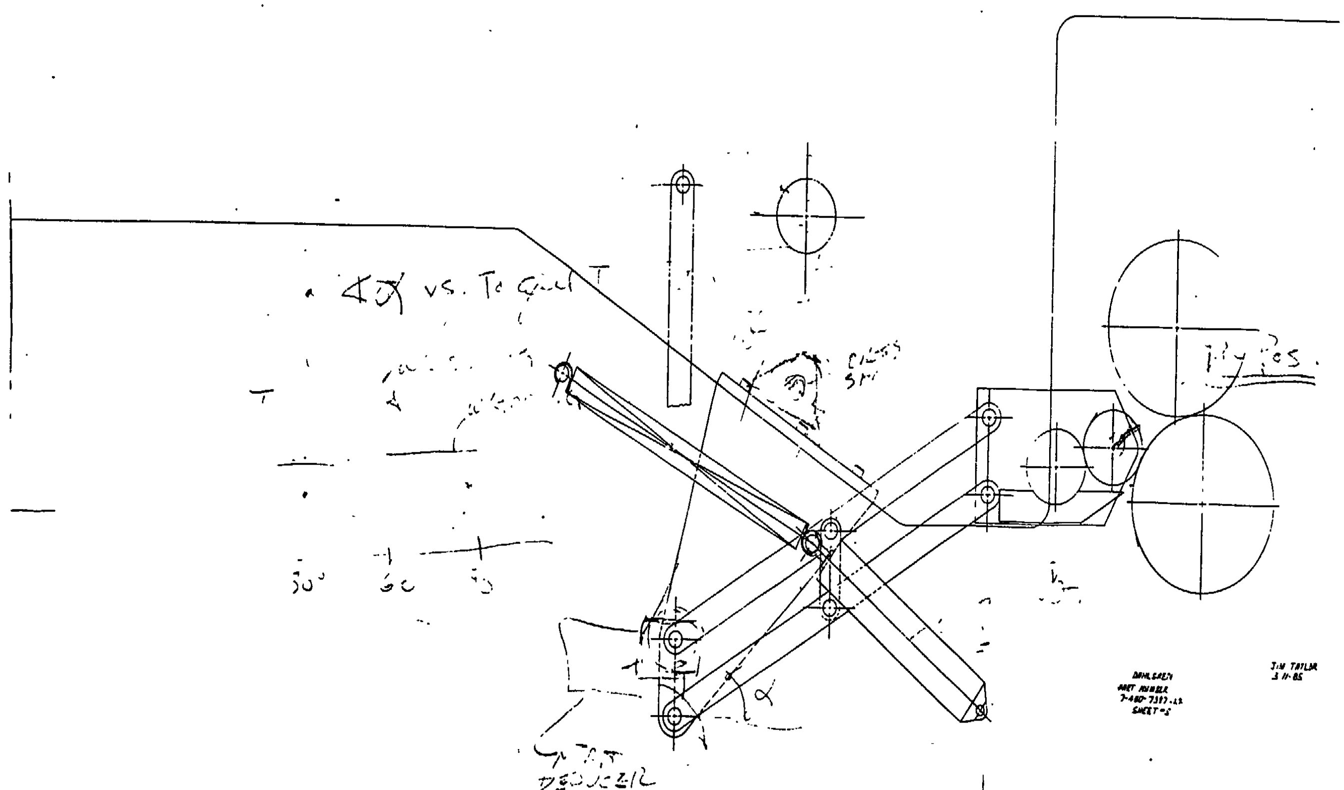
W019000



09115796 .052501

W019001


DR. SELBY
SCALE 2:1
SHEET #6



09315796.052501

W019002

PRIOR ART PATENTS

PRIOR ART

TAB NO.	PATENT NO. AND TITLE	ASSIGNEE/INVENTOR	ISSUE DATE
1	U.S Patent No. 2,279,204 Printing Cylinder	*Metal Press Mfg.* John P.E. Neilson	04/07/42
2	U.S. Patent No. 2,320,523 Dampening Roll for Printing Presses	*The Chandler & Price Co.* Joseph F. Jirousek	06/01/43
3	U.S. Patent No. 2,333,962	Thomas A. Terry	11/09/43
4	CH 319962 Farbwerk füBuchdruck; Offset druck-und dergleichen Maschinen für Farbendruck	*Maschinenfabrik Winkler, Fallert & Co. AG* Paul Heimlicher	03/15/57
5	Great Britain Patent No. 924401 Improvements in or relating to Ink Supplying Means for Rotary Printing Machines	Ernest Arthur Timson	04/24/63
6	U.S. Patent No. 3,397,675 Coating Apparatus	*West Virginia Pulp & Paper Co.* John De Ligt	08/20/68
7	U.S. Patent No. 3,433,155 Mechanism for Applying a Coating to a Plate	*Harris Intertype Corp.* Robert K. Norton	03/18/69
8	U.S. Patent No. 3,536,006 Multicolor Rotary Offset Printing Press with Cylinder Interruption	*Vandercook & Sons, Inc.* James Burton Roozee	10/27/70
9	U.S. Patent No. 3,604,350 Flexographic Presses with Interrupter and Cylinder Register Mechanisms	Lawrence Rosenstadt	09/14/71

TAB NO.	PATENT NO. AND TITLE	ASSIGNEE/INVENTOR	ISSUE DATE
10	U.S. Patent No. 3,749,011 Damping Device for Lithographic Printing Presses	*Roland Offsetmaschinenfabrik Faber & Schleicher AG* Paul Abendroth, Hans Alix, Friedrich Preuss, Fred Kunkel	07/31/73
11	U.S. Patent No. 3,768,438 Machine for Coating Sheets of Paper and the like with Liquid Coating Materials	Wilhel Kumpf	10/30/73
12	U.S. Patent No. 3,800,743 Materials Application Apparatus	*Xerox Corporation* Raymond K. Egnaczak	04/02/74
13	U.S. Patent No. 3,916,824 Device for Coating Strip Material in Continuous Operations	*Aluminum Norf GmbH* Peter Knodel, Gerhard Mayer, Horst Munsterer, Reinbold Wagner	11/04/75
14	U.S. Patent No. 3,931,791 Mechanism for Applying Lacquers and the like on a Printing Press	*Roland Offsetmaschinenfabrik Faber & Schleicher AG* Friedrich Preuss and Kurt Difflipp	01/13/76
15	U.S. Patent No. 3,986,452 Liquid Applicator for Lithographic Systems	*Dahlgren Manufacturing Company, Inc.* Harold P. Dahlgren	10/19/76
16	DE 21 51 185 B2 Mechanism for Applying Laquers and the like on a Printing Press	*Maschinenfabrik Augsburg-Nurnberg AG* Hermann Fischer	07/19/79
17	U.S. Patent No. 4,165,688 Ink Dam for Printing Press	*Magna-Graphics Corporation* Dale D. Leanna and Allen R. Jorgensen	08/28/79
18	U.S. Patent No. 4,222,325 Mounting Means for Movable Carriage on an Offset Press	*White Consolidated Industries, Inc.* Robert Edwards	09/16/80
19	U.S. Patent No. 4,270,483 Printing Coater	Denton G. Butler and Andrew W. Lester	06/02/81

TAB NO.	PATENT NO. AND TITLE	ASSIGNEE/INVENTOR	ISSUE DATE
20	U.S. Patent No. 4,308,796 Offset Lithographic Press with Ink Metering System for Blanket Cylinder	*S-W-H Ltd.* William L. Satterwhite	01/05/82
21	U.S. Patent No. 4,372,244 Varnishing Units on Printing Presses	*M.A.N.-ROLAND Druckmaschinen AG* Herbert Rebel	02/08/83
22	U.S. Patent No. 4,379,039 Ultraviolet Curable Resin Composition	Toyo Boseki Kabushiki Kaish Hiroshi Fujimoto, Hideo Miyake	04/05/83
23	U.S. Patent No. 4,396,650 Primed Inorganic Substrates Overcoated with Curable Protective Compositions	*Minnesota Mining & Mfg. Co.* Roger W. Lange, Alek P. Szecsy	08/02/83
24	U.S. Patent No. 4,397,237 Roller Train Structure for use with Printing Machine	*M.A.N.-ROLAND Druckmaschinen AG* Manfred Makosch	08/09/83
25	U.S. Patent No. 4,399,767 Varnishing Unit in the Delivery Unit of a Sheet-Fed Rotary Printing Press	*M.A.N.-ROLAND Druckmaschinen AG* Claus Simeth	08/23/83
26	U.S. Patent No. 4,402,267 Method and Apparatus for Handling Printed Sheet Material	*Printing Research Corporation* Howard W. DeMoore	09/06/83
27	U.S. Patent No. 4,421,027 Multiple Printing Mode Printing Machine System	*M.A.N.-ROLAND Druckmaschinen AG* Hermann Fischer	12/20/83
28	U.S. Patent No. 4,423,677 Rotary Sheet Offset Printing Machine	*M.A.N.-ROLAND Druckmaschinen AG* Hermann Fischer	01/03/84
29	U.S. Patent No. 4,446,814 Device for Applying a Fluid, in Particular Lacquers on Printed Sheets or Continuous Webs	*M.A.N.-ROLAND Druckmaschinen AG* Paul Abendroth, Janko Despot	05/08/84

TAB NO.	PATENT NO. AND TITLE	ASSIGNEE/INVENTOR	ISSUE DATE
30	U.S. Patent No. 4,451,509 Radiation-Hardenable Aqueous Binder Emulsions of Acrylate Prepolymer with Unsaturated Polyester Emulsifier Having Benzyloxy and Alkylene-Oxy Groups	*Bayer Aktiengesellschaft* Walter Frank, Otto Bendszus, Jurgen Meixner, Hans J. Freier, Hans-Jaochim Traenckner	05/29/84
31	U.S. Patent No. 4,501,223 Coating Apparatus	*Hitachi Zosen Corporation* Sadayuki Matsuno, Hiroshi Itoh, Isamu Nishikawa, Tatsuo Awazu, Toshio Matsunaga, Yoshitaka Kitaoka, Goro Sugimoto, Hiroki Nishinaka	02/26/85
32	U.S. Patent No. 4,524,712 Varnish Coater for Printed Product	*Komori Printing Machinery Co., Ltd.*/Kiyoshi Ito	06/25/85
33	U.S. Patent No. 4,536,218 Process and Compositions for Lithographic Printing in Multiple Layers	Eli A. Ganho	08/20/85
34	U.S. Patent No. 4,569,306 Varnish Coater for Printed Product	*Komori Printing Machinery Co., Ltd.* Kiyoshi Ito, Tamotsu Omori	02/11/86
35	U.S. Patent No. 4,574,732 Overvarnish Unit	*Feco Engineered Systems, Inc.* William G. Verwey, John C. Hovekamp	03/11/86
36	U.S. Patent No. 4,586,434 Device for Replacing Plate Cylinders	*Rengo Co., Ltd.* Masateru Tokuno, Tetsuya Sawada Hidetoshi Hoshiyama Toshihiro Yoneda	05/06/86
37	U.S. Patent No. 4,615,293 Medium-Applying Device in a Printing Machine	*Heidelberger Druckmaschinen AG* Hans-Georg Jahn	10/07/86

TAB NO.	PATENT NO. AND TITLE	ASSIGNEE/INVENTOR	ISSUE DATE
38	U.S. Patent No. 4,617,865 Liquid Coater for a Printing Press with Moveable Inking Roller and Tray	*Ryco Graphic Mfg., Inc.* Thomas G. Switall	10/21/86
39	EP 0270 054 A2 Slip Sheet Insertion-Delivery Apparatus for Sheet-Fed Printing Press	*Komori Printing Machinery Co.* Toshio Hoshi	12/04/86
40	EP 0293 586 A2 Geteilter Farbkasten für eine Flexodruckmaschine	*M.A.N.- ROLAND Druckmaschinen AG* David J. Sarazen	05/29/87
41	U.S. Patent No. 4,685,414 Coating Printed Sheets	Mark A. DiRico	08/11/87
42	U.S. Patent No. 4,704,296 Web Coating Method and Apparatus	*Magna-Graphics Corp.* Dale D. Leanna, Eugene R. Wittkopf, Allen R. Jorgensen	11/03/87
43	U.S. Patent No. 4,706,601 Device for Applying Medium After Termination of Printing Operation in a Printing Machine	*Heidelberger Druckmaschinen AG* Hans-Georg Jahn	11/17/87
44	U.S. Patent No. 4,753,166 Printing Machine Ink Smoother	*M.A.N.- ROLAND Druckmaschinen AG* Hermann Fischer	06/28/88
45	U.S. Patent No. 4,779,557 Coater for a Sheet Fed Printing Press	Joseph Frazzitta	10/25/88
46	U.S. Patent No. 4,796,528 Separated Ink Fountain for a Flexographic Printing Machine	*M.A.N. - ROLAND Druckmaschinen AG* David J. Sarazen	01/10/89
47	U.S. Patent No. 4,796,556 Adjustable Coating and Printing Apparatus	*Birow, Inc.* John W. Bird	01/10/89

TAB NO.	PATENT NO. AND TITLE	ASSIGNEE/INVENTOR	ISSUE DATE
48	U.S. Patent No. 4,815,413 Varnishing Apparatus for Printed Sheet	*Komori Printing Machinery Co., Ltd.* Toshio Kota	03/28/89
49	U.S. Patent No. 4,821,672 Doctor Blade Assembly with Rotary End Seals and Interchangeable Heads	Nick Bruno	04/18/89
50	U.S. Patent No. 4,825,804 Vertically Retracting Coater	*Dahlgren International, Inc.* Mark A. Dirico, Phillip Rodriguez	05/02/89
51	U.S. Patent No. 4,841,903 Coating and Printing Apparatus Including an Interstation Dryer	*Birow, Inc.* John W. Bird	06/27/89
52	U.S. Patent No. 4,848,265 Printing Apparatus having Coating Function	*Komori Printing Machinery Co., Ltd.* Tatsuo Komori	07/18/89
53	U.S. Patent No. 4,852,515 Device for Automatically Controlling Coating Amount for Use in Coating Machine	*Chugai Ro Co, Ltd.* Yoshiyasu Terasaka, Masao Tanabe	08/01/89
54	U.S. Patent No. 4,882,991 Change-Over Inking Unit of a Sheet-Fed Rotary Press	*M.A.N. - ROLAND Druckmaschinen AG* Claus Simeth	11/28/89
55	U.S. Patent No. 4,889,051 Removable Inking Device for Offset Press	Jean-Claude Sarda	12/26/89
56	U.S. Patent No. 4,895,070 Liquid Transfer Assembly and Method	*Birow, Inc.* John W. Bird	01/23/90

TAB NO.	PATENT NO. AND TITLE	*ASSIGNEE*/INVENTOR	ISSUE DATE
57	U.S. Patent No. 4,919,048 Apparatus for Preventing Contact of Wet Ink Sheets with Printing Press Delivery Mechanisms and for Drying Said Wet Ink	Jack D. Tyler	04/24/90
58	U.S. Patent No. 4,934,305 Retractable Coater Assembly including a Coating Blanket Cylinder	*Dahlgren International, Inc.* Jamie E. Koehler, James E. Taylor	06/19/90
59	U.S. Patent No. 4,936,211 Multicolor Offset Press with Segmental Impression Cylinder Gear	*Presstek, Inc.* Frank G. Pensavecchia, Richard A. Williams, John P. Gardiner, Stephen M. Laponsey, John F. Kline	06/26/90
60	U.S. Patent No. 4,939,992 Flexographic Coating and/or Printing	*Birow, Inc.* John W. Bird	07/10/90
61	U.S. Patent No. 4,977,828 Transfer Roller Device for Printing Presses	*Printing Research, Inc.* David D. Douglas	12/18/90
62	GB 2263 438 A Printing Apparatus	*The Langston Company* Joseph John Weishew	01/22/92
63	U.S. Patent No. 5,088,404 Delivery Apparatus for Printing Press	Edward P. MacConnell, Shigeki Matsukawa	02/18/92
64	U.S. Patent No. 5,107,790 Two Headed Coater	*Rapidac Machine Corp.* Larry J. Sliker, Robert S. Conklin	04/28/92
65	U.S. Patent No. 5,127,329 Vacuum Tansfer Apparatus for Rotary Sheet-Fed Printing Presses	*Howard W. DeMoore* Howard W. DeMoore	07/07/92
66	U.S. Patent No. 5,176,077 Coating Apparatus for Sheet-Fed, Offset Rotary Printing Presses	Howard W. DeMoore, David D. Douglas, and Steven M. Person	01/05/93

TAB NO.	PATENT NO. AND TITLE	ASSIGNEE/INVENTOR	ISSUE DATE
67	U.S. Patent No. 5,178,678 Retractable Coater Assembly Including a Coating Blanket Cylinder	*Dahlgren International, Inc.* Jamie E. Koehler, James E. Taylor, Mark A DiRico	01/12/93
68	U.S. Patent No. 5,189,960 Apparatus and Method for Controlling Temperature of Printing Plate on Cylinder in Rotary Press	Fredric Valentini, David W. Moore	03/02/93
69	U.S. Patent No. 5,209,179 Liquid Coating Apparatus for Use in Conjunction with Printing Presses Where Access of the Coating Apparatus to the Press Cylinders is Restricted	*Herbert Productions, Inc.* John C. Herbert, Frank A. Andaloro	05/11/93
70	EP 0647 529 A1 High Velocity, Hot Air Dryer and Extractor	*Howard W. DeMoore* Howard Warren DeMoore	10/06/93
71	U.S. Patent No. 5,335,596 Coating Apparatus for Sheet-Fed, Offset Rotary Printing Presses	*Howard W. DeMoore* Howard W. DeMoore, Steven M. Person	08/09/94
72	DE 4311 834 A1 Einrichtung zum Besshichten von Bedruckstoffen in Druckmaschinen	*M.A.N.-ROLAND Druckmaschinen AG* Georg Hartung, Ulrich Jung, Juergen Schneider	10/13/94
73	U.S. Patent No. 5,476,041 Printing Press Having a Device for Controlling the Air in a Sheet Feeder	*Heidelberger Druckmaschinen AG* Ernst Czotscher	12/19/95

1

April 7, 1942. J. P. E. NEILSON 2,279,204

PRINTING CYLINDER

Filed Dec. 13, 1940 2 Sheets-Sheet 1

Fig. 1.

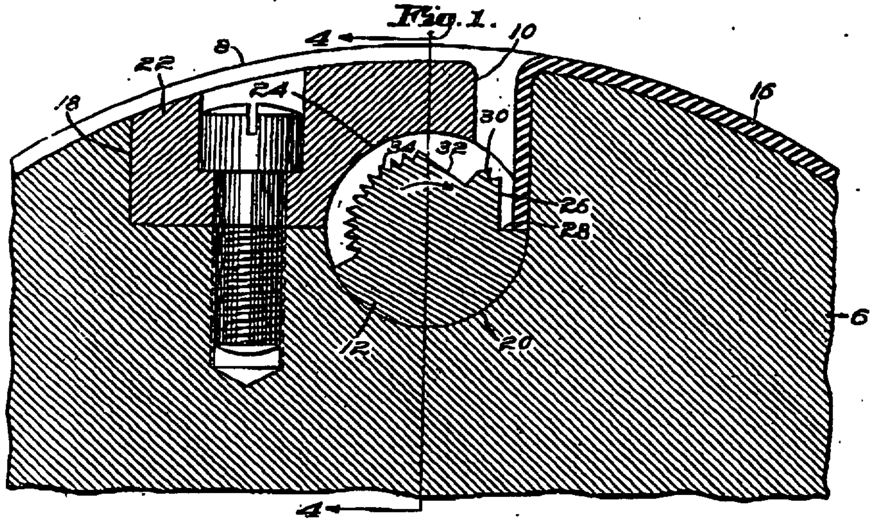
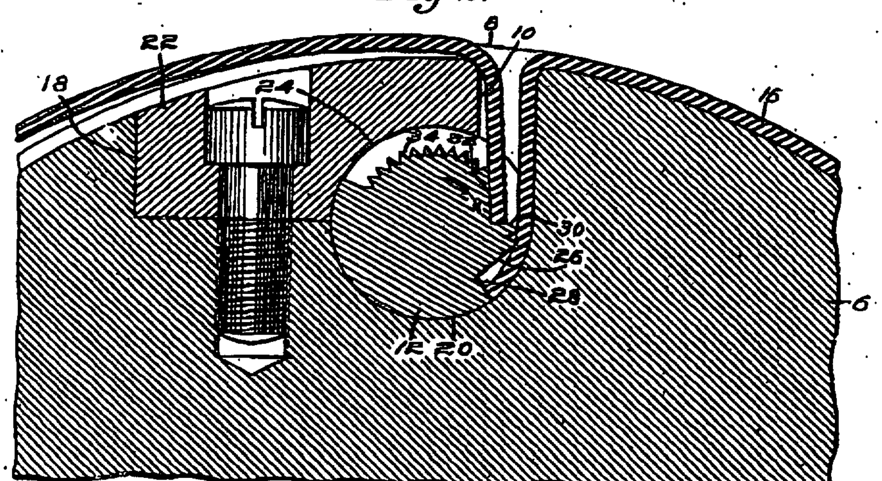


Fig. 2.



Inventor:
John P. E. Neilson,
by Emery, Booth, Townsend, Miller & Weidner
Attys.

April 7, 1942. J. P. E. NEILSON 2,279,204

PRINTING CYLINDER

Filed Dec. 13, 1940 2 Sheets-Sheet 2

Fig. 3.

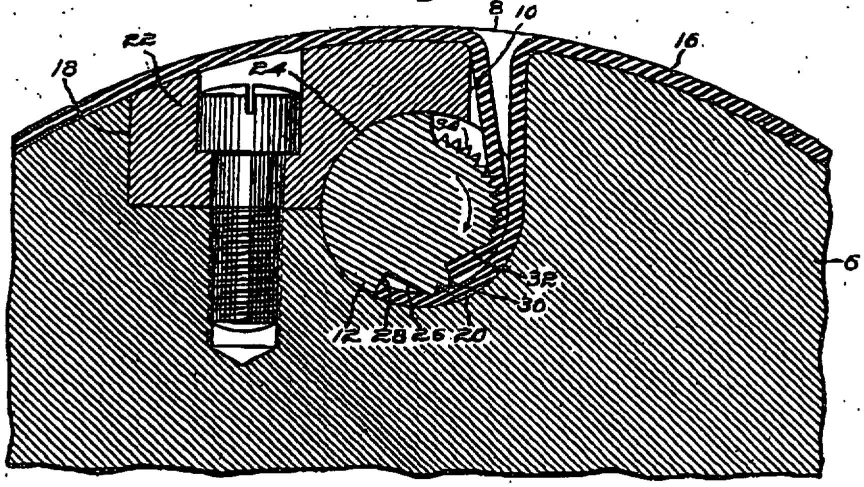
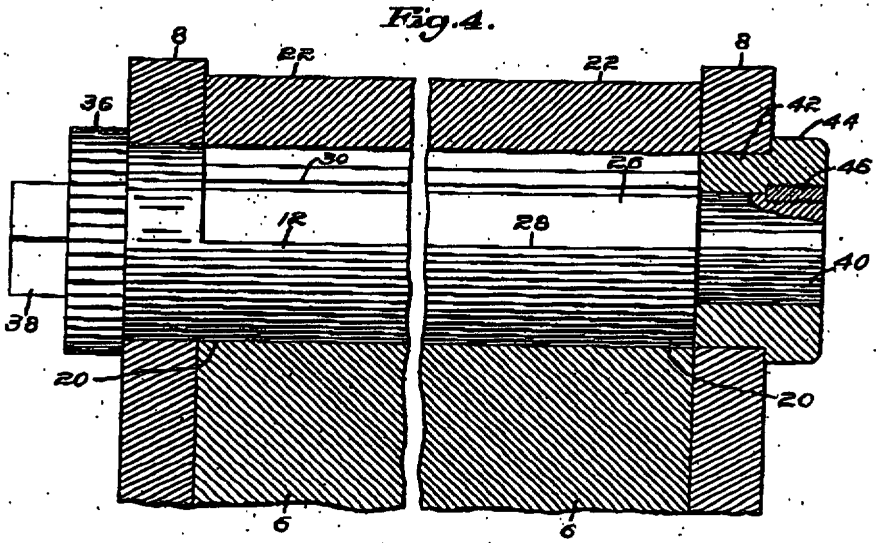


Fig. 4.



Inventor:
John P. E. Neilson,
by Carey, Booth, Townsend, Miller & Mercer
Attys.

Patented Apr. 7, 1942 2,279,204

UNITED STATES PATENT OFFICE

2,279,204

PRINTING CYLINDER

John P. E. Neilson, Quincy, Mass., assignor to Meisel Press Manufacturing Company, Boston, Mass., a corporation of Massachusetts

Application December 13, 1940, Serial No. 369,969

9 Claims. (Cl. 101—415.1)

This invention relates to cylinders and the object is to provide an improved construction facilitating the tight application of a flexible member to the surface of the cylinder and ensuring its secure retention thereon.

My invention will be well understood by reference to the following description taken in connection with the accompanying drawings, wherein—

Figs. 1, 2 and 3 are partial transverse sections through the cylinder illustrating successive steps in securing ends of flexible members thereto; and

Fig. 4 is a broken section on the line 4—4 of Fig. 1, the flexible member being omitted.

Referring to the drawings, I there show a printing cylinder 6 organized between the usual terminal bearers 8 (Fig. 4). The body of the cylinder between the bearers is provided with a gap opening to the surface of the cylinder through a narrow longitudinal slot 10 and within which, inwardly of said slot, lies a reel rod 12 more fully hereinafter described. About the surface of the cylinder is wrapped a flexible member 16, such, for example, as a rubber blanket or a rubber printing plate and either the two ends of a single encircling member or the opposed ends of separate members, the opposite ends of which are secured to the cylinder in the same or some other manner elsewhere in the circumference, are adapted to enter the slot 10 and be secured by the reel rod 12 within the gap. For convenience I will refer in the following description to the flexible member as a "blanket" and in the claims to avoid awkwardness of expression will refer to the ends which are engaged as the ends of "a flexible member."

The preferred mechanical construction herein illustrated as forming the slot 10 and providing for the mounting of the reel rod 12 comprises a generally rectangular recess 18 formed in the body 6 of the cylinder, the bottom of the recess being provided with a groove 20 semi-circular in cross-section and tangent to the right-hand side of the recess viewing Figs. 1, 2 and 3. A filler block 22 is secured in the recess at the left-hand side thereof, this block having an outer surface continuing the contour of the cylinder and an overhanging portion provided with a segmental groove 24 which, when the parts are assembled, matches the groove 20. The member terminates a short distance from the right-hand wall of the recess, thus defining the narrow slot 10 which opens tangentially to a cylindrical seat formed by the cooperation of the two grooves and adapted to receive the reel rod 12 which is generally of the form of a cylinder corresponding in diameter to the seat referred to.

The single reel rod 12 herein is adapted to engage successively the ends of the blanket 16 to draw these ends down into the gap to secure the blanket in tight encircling relation to the cylinder and to clamp these ends against the wall of the gap in direct engagement one with the other. Referring to Fig. 1, the rod 12 may be cut away to provide a seat 26 for the right-hand end of the blanket 16. This seat preferably takes the form shown of a half a circular segment defining an abrupt shoulder 28 and an unobstructed portion above the same so that, with the rod in the position of rotative adjustment shown in Fig. 1, the right-hand end of the blanket 26 may be thrust in through the slot 10 by a mere movement of approach substantially radial to the cylinder as a whole until the edge of the end engages the shoulder 28. To the rear of the seat 26, considering the forward rotation of the reel rod to clamping position, or counterclockwise viewing the figures, there is provided a clamping shoulder 30 which as a matter of mechanical construction is formed by a slight reduction or cutting away of the cylindrical rod at this point in an amount somewhat smaller than the normal thickness of the blanket 16. To permit this portion 30 not only to press against the end of the blanket but to grip the same to effect downward traction thereon, it is preferably toothed, herein with long rib-like teeth extending along the length of the cylinder.

One end of the blanket being engaged in the seat 26, as shown in Fig. 1, the reel rod 12 is rotated clockwise and the toothed portion 30 engages the end of the blanket and, the teeth gripping the same, the end is carried down to the position shown in Fig. 2, tensioning the blanket over the right-hand margin of the slot 10 at the cylinder surface and pressing the end against the opposed wall of the gap as defined by the groove 20. To the rear of the portion 30 there is provided a seat 32 similar to the seat 26 which is then brought into position beneath the slot 10, as illustrated in Fig. 2. To the rear of the seat 32 the rod is again cut away to provide a toothed clamping portion 34 similar to the portion 30 but preferably of somewhat lesser radial depth measured from the center of the rod and of substantially greater circumferential extent for reasons which will appear. The right-hand end of the blanket is inserted through the slot 10 and placed in the seat 32, as shown in Fig. 2. Continued clockwise motion of the reel rod will

then bring the parts to substantially the position of Fig. 3 in which it will be seen that the movement of the left-hand end of the blanket under the gripping action of the portion 30 has continued while the portion 24 grips the right-hand end of the blanket, draws it down through slot 18, presses it directly against the right-hand end and clamps both of them firmly against the wall of groove 20. The relatively reduced height of shoulder 34 accommodates the double thickness and its circumferential length provides for a wide range of rotative adjustment. Thus a further movement beyond the position of Fig. 3 and continued take-up of the blanket is clearly possible.

Reverse rotation of the reel rod, that is, in a counterclockwise direction, viewing Fig. 3, will free the ends of the blanket, and it is to be noted that, since the ends of the blanket engage the abrupt shoulder 28 of seat 26 and the corresponding shoulder of seat 32, these shoulders will feed backwardly the end portions of the blanket and positively eject them free of the reel rod.

In the mechanical construction shown in the drawing the reel rod has a considerable cylindrical surface which finds a bearing throughout its length on the seat provided by the grooves 20 and 24. In Fig. 4 I have shown the left-hand end of the rod extending through the left-hand bearer 8 and as provided with an integral flange 36 to overlie the face of that bearer and a squared portion 38 by which it may be turned. The flange 36 is herein shown as a ratchet wheel to engage a retaining pawl, not shown, for holding the rod in position after the blanket has been tightened up. The other end of the rod may be provided with a reduced end 40 on which fits a sleeve 42 providing a bearing in the right-hand bearer 8 and having the flange 44 overlying the outer face of the same, this sleeve being secured in position by the key screw 46. Obviously the reel rod may be assembled in its seat by being introduced thereinto from the left-hand side, viewing Fig. 4, and secured by the application of the sleeve 42, either before or after the block 22 is secured in place.

I am aware that the invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof, and I therefore desire the present embodiment to be considered in all respects as illustrative and not restrictive; reference being had to the appended claims rather than to the foregoing description to indicate the scope of the invention.

I claim:

1. A printing cylinder having a gap into which the ends of a flexible member leading from either side thereof may extend, a reel rod rotatably mounted within the gap, the rod being of generally cylindrical form, the wall of the gap having a corresponding cylindrical surface opposing the rod, the rod having seats at circumferentially spaced points to receive the ends of such a member and having portions following the seats to provide for pressing the ends against said wall on rotation of the rod.

2. A printing cylinder having a gap into which the ends of a flexible member leading from either side thereof may extend, a reel rod rotatably mounted within the gap, the rod being of generally cylindrical form, the wall of the gap having a corresponding cylindrical surface opposing the rod, the rod having unobstructed seats at circumferentially spaced points into which the ends of such a member may be introduced by a simple movement of approach in a direction substantially radial to the cylinder when the seats are faced outwardly to the gap and also having portions following the seats to provide for pressing the ends against the wall on rotation of the rod, said portions having teeth to grip the portions of the end engaged thereby.

3. A printing cylinder having a gap into which the ends of a flexible member leading from either side thereof may extend, a reel rod rotatably mounted within the gap, the rod being of generally cylindrical form, the wall of the gap having a corresponding cylindrical surface opposing the rod, the rod having at circumferentially spaced points seats substantially of the form of a half segment to receive the ends of such a member and having portions following the seats to provide for pressing the ends against said wall as the rod is rotating to carry the seats away from a position facing outwardly in the gap.

4. A printing cylinder having a gap into which the ends of a flexible member leading from either side thereof may extend, a reel rod rotatably mounted within the gap, the rod being of generally cylindrical form, the wall of the gap having a corresponding cylindrical surface opposing the rod, the rod having at circumferentially spaced points seats substantially of the form of a half segment to receive the ends of such a member and having portions provided with gripping teeth, which portions follow the seats to provide for pressing the ends against said wall as the rod is rotating to carry the seats away from a position facing outwardly in the gap.

5. A printing cylinder having a gap into which the ends of a flexible member leading from either side thereof may extend, a reel rod rotatably mounted within the gap, the rod being of generally cylindrical form, the wall of the gap having a corresponding cylindrical surface opposing the rod, the rod having at circumferentially spaced points seats for the ends of such a member, one at least of the seats having an abrupt, rearwardly facing shoulder and being unobstructed rearwardly of the shoulder, whereby when said seat is faced outwardly the end of a member may be freely introduced by a simple movement of approach radial to the cylinder to oppose the edge of the end to said shoulder, the rod having a toothed portion following the seat which on rotation of the rod grips the end and presses it against the wall.

6. A printing cylinder having a generally rectangular recess, the bottom of the recess having a semi-circular groove substantially tangent to one of the sides, a member fitted into the recess at the other side thereof, said member having an outer surface continuing the contour of the cylinder and a segmentally grooved inner surface matching with said semi-circular groove and being terminally spaced from the first side to provide a slot opening to said grooves, and a reel rod rotatably mounted in the seat formed by said grooves having means for engaging the end of a covering member for the cylinder, which end is entered into said slot.

7. A printing cylinder having a longitudinal opening therein beneath the surface thereof intersected by a relatively narrow slot opening to the exterior of the cylinder, said opening being completely cylindrical except where it is joined substantially tangentially by said slot, a reel rod fitting said opening and cut away at spaced locations to provide seats to receive end portions of a flexible member and clamping shoulders at the rear of said seats.

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8. A printing cylinder having a longitudinal opening therein beneath the surface thereof intersected by a relatively narrow slot opening to the exterior of the cylinder, said opening being completely cylindrical except where it is joined substantially tangentially by said slot, a reel rod fitting said opening and cut away at spaced locations to provide seats to receive end portions of a flexible member, said seats having closed forward ends against which the end surfaces of the member may abut.

9. A printing cylinder having a gap into which the end portions of a flexible member leading from either side thereof may extend, a reel rod rotatably mounted within the gap having seats to receive such end portions and constructed and arranged on rotation of the rod in one direction to grip said end portions and draw them inwardly, said rod also presenting shoulders to the end surfaces of said portions whereby on reverse rotation the latter are positively ejected free of the reel rod.

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June 1, 1943. J. F. JIROUSEK 2,320,523

DAMPENING ROLL FOR PRINTING PRESSES

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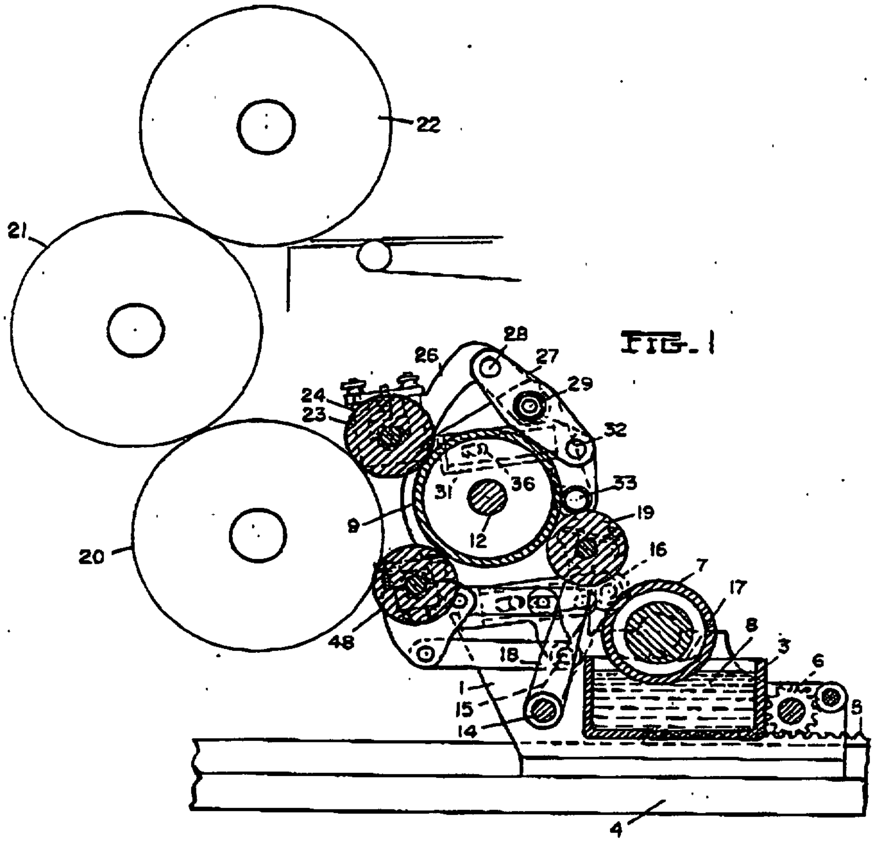

FIG. 1

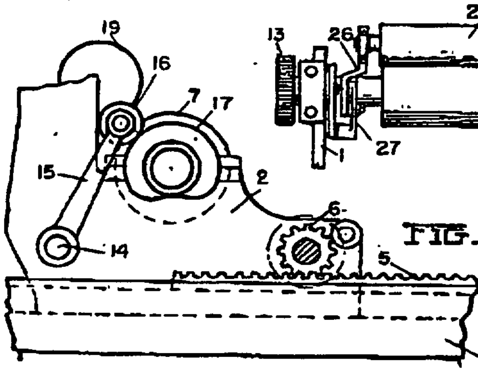

FIG. 2

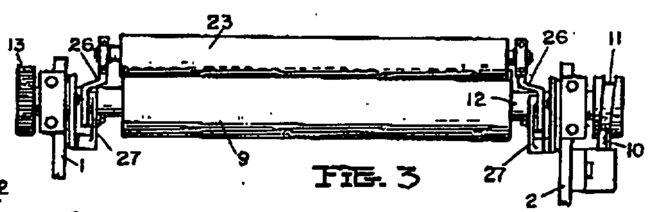

FIG. 3

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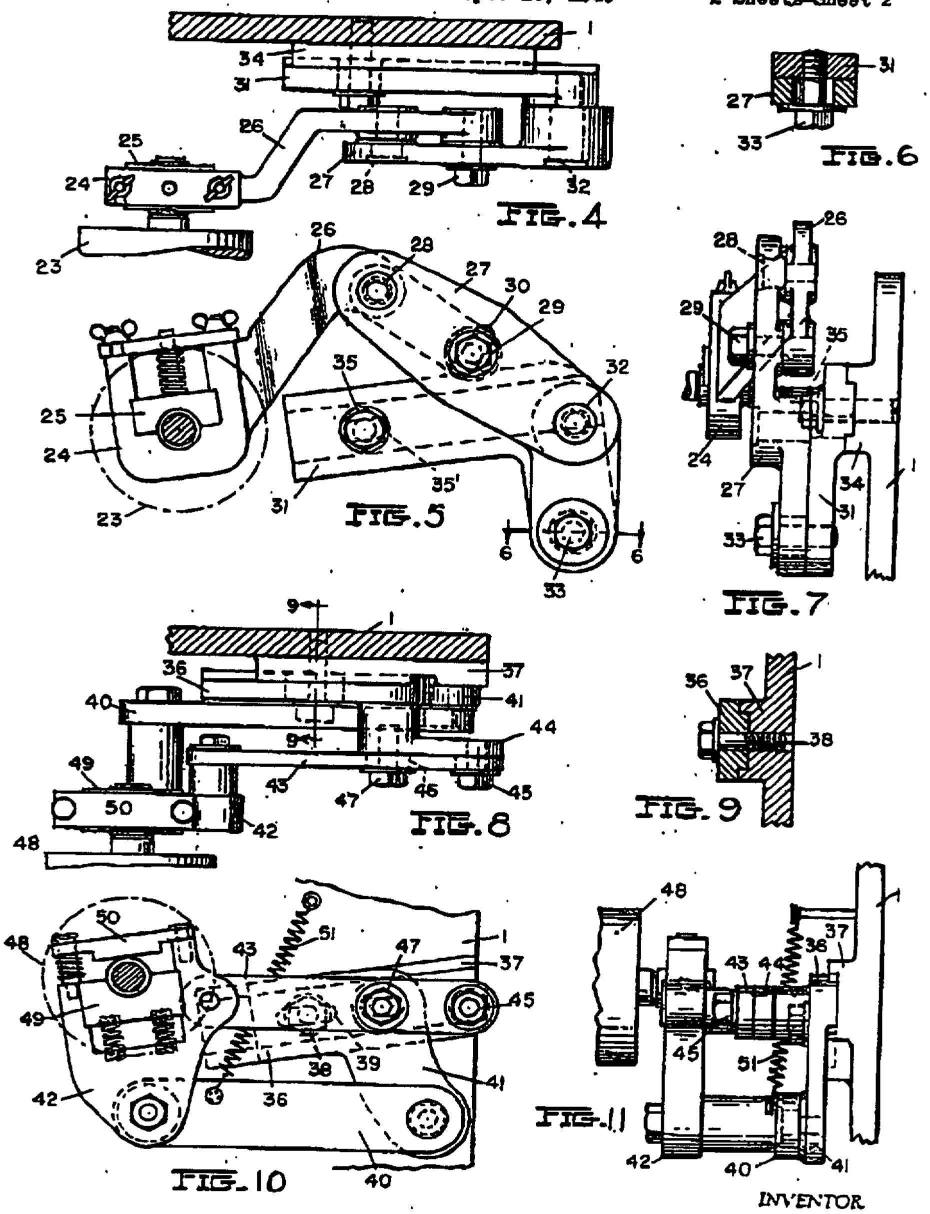
DAMPENING ROLL FOR PRINTING PRESSES

Filed Sept. 13, 1940 2 Sheets-Sheet 2



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Patented June 1, 1943 2,320,523

UNITED STATES PATENT OFFICE

2,320,523

DAMPENING ROLL FOR PRINTING PRESSES

Joseph F. Jirousek, Cleveland, Ohio, assignor to The Chandler & Price Company, Cleveland, Ohio, a corporation of Ohio

Application September 13, 1940, Serial No. 356,675

8 Claims. (Cl. 101—147)

This invention relates, as indicated, to dampening rolls for printing presses, and more particularly to means for mounting such rolls in order that they may be substantially self-adjusting. Such means are particularly adapted for use in conjunction with an offset lithographic press of the type illustrated and described in Jirousek Patent No. 2,109,486.

In a lithographic press it is of course necessary to wet the lithographic cylinder in order that the ink may not adhere to the unetched surfaces of such cylinder. Various dampening or water transfer means have been employed in the past for this purpose and have generally embodied relatively complex movements requiring the most delicate adjustment by the operator. Such adjustment has tended to consume a disproportionate amount of the operator's time and the results obtained have not always been satisfactory due to the difficulty of obtaining the precise adjustment required to afford an absolutely uniform contact of the dampening rolls with the lithographic cylinder and also the roller from which the film of water is transferred.

It is therefore, as above indicated, a primary object of this invention to provide dampening rolls for use with lithographic presses and the like, which rolls will be substantially self-adjusting and which may then be simply locked in place by the operator.

It is a further object of this invention to provide such dampening rolls and mounting means therefor which will be relatively simple in construction and will require a minimum of attention from the operator.

Other objects of this invention will appear as the description proceeds.

To the accomplishment of the foregoing and related ends, said invention, then, consists of the means hereinafter fully described and particularly pointed out in the claims.

The annexed drawings and the following description set forth in detail certain mechanism embodying the invention, such disclosed means constituting, however, but one of various mechanical forms in which the principle of the invention may be used.

In said annexed drawings:

Fig. 1 is a vertical sectional view taken through the entire water supply mechanism and showing the same in operative relation to the lithographic cylinder;

Fig. 2 is a fragmentary side elevational view of a portion of the carriage supporting such water supply means;

Fig. 3 is a top view of the upper dampening roll and the intermediate water supply roller;

Fig. 4 is a top view of the mounting means for one end of said upper dampening roll;

Fig. 5 is a side elevational view of such mounting means;

Fig. 6 is a sectional view taken along the line 6—6 on Fig. 5;

Fig. 7 is a view of such mounting means normal to that of Fig. 5;

Fig. 8 is a top view of the mounting means for the lower dampening roll;

Fig. 9 is a sectional view taken along the line 9—9 on Fig. 8;

Fig. 10 is a side elevational view of such lower mounting means; and

Fig. 11 is a view of such mounting means taken normal to that of Fig. 10.

Referring now more particularly to such drawings and especially Figs. 1, 2 and 3, the water supply means of this invention comprises carriage means having side frame members 1 and 2 between which is carried the water fountain 3. Such carriage may be moved forward and backward relatively to the frame 4 of the press by means of rack 5 and pinion 6. Mounted in said carriage frame above fountain 3 is a pick-up roller 7 adapted to dip into the water 8 of such fountain. An intermediate roller 9 is also supported in said carriage somewhat above such pick-up roller and means are provided for reciprocating the same comprising a pin 10 in a cam guide 11 positioned on the end of the shaft 12 on which such intermediate roller is mounted. The other end of the shaft carries a gear 13 whereby the same may be driven. Keyed to shaft 14 is a lever arm 15 carrying at its end a cam roller 16 adapted to ride on cam 17 carried by the shaft on which pick-up roller 7 is mounted. Also keyed to shaft 14 is a pair of longer lever arms such as 18 carrying a roller 19. As pick-up roller 7 and cam 17 rotate, lever arm 15 and thus lever arm 18 will be intermittently oscillated so that roller 19 alternately contacts the surface of the pick-up roller 7 and intermediate roller 9, being effective to transfer a thin film of water to such latter roller.

Means are then provided, with which the present invention is more particularly concerned, for transferring the water from such intermediate roller to the lithographic cylinder 20 of the press, such cylinder, when inked, being operative in conjunction with offset cylinder 21 and impression cylinder 22 to transfer the desired design to the sheets carried by such impression cylinder.

Referring now in addition to Figs. 4 to 7, one

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element of the dampening means comprises an upper dampening roll 23 carried in split bearing mounts comprising a substantially U-shaped member 24 and a spring backed block 25 adapted to permit resilient upward movement of such roll should such ever be necessary to permit the roll to adapt itself to the surfaces with which it is engaged. Bearing mount 24 is supported by an angular link 26 pivotally mounted on a second link 27 by bolting means 28. An oversize hole is provided in said first-named link member in order to permit some play thereto, pivotal movement about bolt 28 being limited in its extent by means of bolt 29 which enters slot 30 in link 27. Said link 27 is in turn pivotally mounted on a bracket 31 by means of bolt 32, its pivotal movement about such bolt being limited by the second bolt 33 connecting angular extensions of such bracket and link and fitting in an oversize hole in such link. Bracket 31 is slidably mounted in a grooved boss 34 of carriage side frame member 1, the degree of slidable movement permitted thereto being limited by a bolt 35 passing through a slot 35' in such bracket. There is of course corresponding supporting means provided for the other end of the dampening roll. Thus when the water fountain carriage has been moved into advanced position, dampening roll 23 will automatically be jostled into proper operative position by contact with cylinder 20 since, as such roll is forced upwardly with resultant pivotal movement about bolts 28 and 32, bracket 31 will slide back proportionately to insure continued engagement of such roll with the surfaces of both cylinder 20 and intermediate roller 9. When the operator has noted that satisfactory positioning has been obtained he need only tighten down bolts 28, 32 and 35 and the mechanism is ready for operation.

Somewhat similar means is provided for obtaining proper contact of the lower dampening roll, although of course gravity cannot be relied upon to bring such roll into proper engagement. Again, the mounting means for only one end of such roll will be described, it being of course understood that duplicate means support the other end. As in the case of the upper roll, a bracket 36 is slidably mounted in a groove in a boss 37 on side frame 1 of the fountain carriage, and a bolt 38 in slot 39 in such bracket likewise limits the extent of slidable movement permitted. A link 40 pivotally connects an extension 41 of such bracket with the lower end of bearing mount 42. A second link 43 above said first-named link also pivotally connects said bearing mount with another extension 44 of such bracket. An oversize hole in such link provides for play for bolt 45 and a slot 46 permits sliding movement of such link relatively to bolt 47. The end of lower dampening roll 48 is supported in a bearing carried by a lower block 49 resiliently mounted in said member 42 and an adjustable upper block 50 engages the upper surface of such bearing to hold the same in place. A coil spring 51 between lower link 40 and frame member 1 is effective to draw the lower dampening roll upwardly into engagement with intermediate roller 9 and the lithographic cylinder 20. Thus when the fountain carriage is moved forward into operative position such lower dampening roll will, upon engagement with cylinder 20, automatically adjust itself so as to maintain proper contact with such cylinder and intermediate roller 9 and the operator need merely tighten bolts 38 and 45 to lock the mechanism in the desired operative position.

It will, therefore, be seen that mechanism has been provided whereby the ends of this invention are accomplished with a minimum of attention by the operator and without the employment of unusually complex or elaborate means.

While the mounting mechanism has been described for use with rollers for dampening lithographic cylinders in cylinder presses, it will, of course, be readily understood that such mechanism may likewise be employed in conjunction with inking rollers and the like wherever it may be desired, including other types of presses.

Other modes of applying the principle of my invention may be employed instead of the one explained, change being made as regards the mechanism herein disclosed, provided the means stated by any of the following claims or the equivalent of such stated means be employed.

I, therefore, particularly point out and distinctly claim as my invention:

1. In combination, a dampening or like roll for printing presses and mounting means for an end thereof comprising a bracket rectilinearly slidable in a plane normal to the axis of said roll, an extension of said bracket pivotally mounted thereon and adapted to support an end of said roll, and means for locking said bracket and extension thereof against further movement when proper adjustment of said roll has been obtained.

2. In combination, a dampening roll for printing presses and mounting means at each end thereof comprising a supporting frame, a bracket mounted thereon for rectilinear sliding movement in a plane normal to the axis of said roll, link means pivotally mounted on said bracket for movement about an axis parallel to said roll, a second link means pivotally mounted on said first link means for like movement, and means for locking said bracket and said link means against further movement when the desired position of said roll has been obtained.

3. In combination, a dampening roll for printing presses and mounting means at each end thereof comprising a supporting frame, a bracket mounted thereon for rectilinear sliding movement in a plane normal to the axis of said roll, link means pivotally mounted on said bracket for movement about an axis parallel to said roll, a second link means pivotally mounted on said first link means for like movement, means for limiting the degree of pivotal movement of each of said links, and means for locking said bracket and links against further movement when proper adjustment of said roll has been obtained.

4. Water supply means for use in conjunction with a lithographic cylinder press comprising a carriage movable toward and away from such lithographic cylinder, a water fount carried thereby, a pick-up roller rotatable in said fount, an intermediate roller, intermittently actuated means for transferring water from said pick-up roller to said intermediate roller, a dampening roll adapted to contact both said intermediate roller and said cylinder and operating to transfer water from said intermediate roller to said cylinder; and mounting means for each end of said dampening roller comprising a bracket mounted on said carriage for rectilinear sliding movement in a plane normal to the axis of said roll, link means pivotally mounted on said bracket for movement about an axis parallel to said roll, a second link means pivotally mounted on said first link means for like movement, means for limiting the degree of pivotal movement of each of said links, and means for locking said bracket

and links against further movement when proper adjustment of said roll has been obtained.

5. Water supply means for use in conjunction with a lithographic cylinder press comprising a carriage movable toward and away from such lithographic cylinder, a water fount carried thereby, a pick-up roller rotatable in said fount, an intermediate roller, intermittently actuated means for transferring water from said pick-up roller to said intermediate roller, a dampening roll adapted to contact both said intermediate roller and said cylinder and operative to transfer water from said intermediate roller to said cylinder; and mounting means for each end of said dampening roll comprising a bracket mounted on said carriage for rectilinear sliding movement in a plane normal to the axis of said roll, link means pivotally mounted on said bracket for movement about an axis parallel to said roll, a second link means pivotally mounted on said first link means, a split bearing carried by said second link means adapted to resiliently support an end of said dampening roll, means for limiting pivotal movement of each of said link means, and means for locking said bracket and link means against further movement when proper adjustment of said dampening roll has been obtained.

6. In combination, a dampening roll for printing presses and mounting means at each end thereof comprising a supporting frame, a bracket mounted thereon for rectilinear sliding movement in a plane normal to the axis of said roll, link means pivotally mounted on said bracket for movement about an axis parallel to said roll, a bearing mount carried by said link and adapted to support an end of said roll, a second link parallel to said first named link pivotally and adjustably connecting said bracket and bearing mount, and means for locking said bracket and second link against further movement when proper adjustment of said roll has been obtained.

7. In combination, a dampening roll for printing presses and mounting means for each end thereof comprising a supporting frame, a bracket mounted thereon for rectilinear movement in a plane normal to the axis of said roll, a link pivotally mounted on said bracket for movement about an axis parallel to said roll, a bearing mount pivotally connected to said link and adapted to support an end of said roll, a second link pivotally and slidably attached to said bracket and pivotally attached to said bearing mount, means for limiting pivotal and sliding movement of said second link, and means for locking said bracket and second link against further movement when proper adjustment of said roll has been obtained.

8. In combination, a dampening roll for printing presses and mounting means for each end thereof comprising a supporting frame, a bracket mounted thereon for rectilinear movement in a plane normal to the axis of said roll, a link pivotally mounted on said bracket for movement about an axis parallel to said roll, a bearing mount pivotally connected to said link and adapted to support an end of said roll, a second link pivotally and slidably attached to said bracket and pivotally attached to said bearing mount, means for limiting pivotal and sliding movement of said second link, spring means operative to draw said bearing mount upwardly, and means for locking said bracket and second link against further movement when proper adjustment has been obtained.

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Nov. 9, 1943. T. A. TERRY 2,333,962

INKING CONVERTER UNIT FOR JOB PRINTING PRESSES AND THE LIKE

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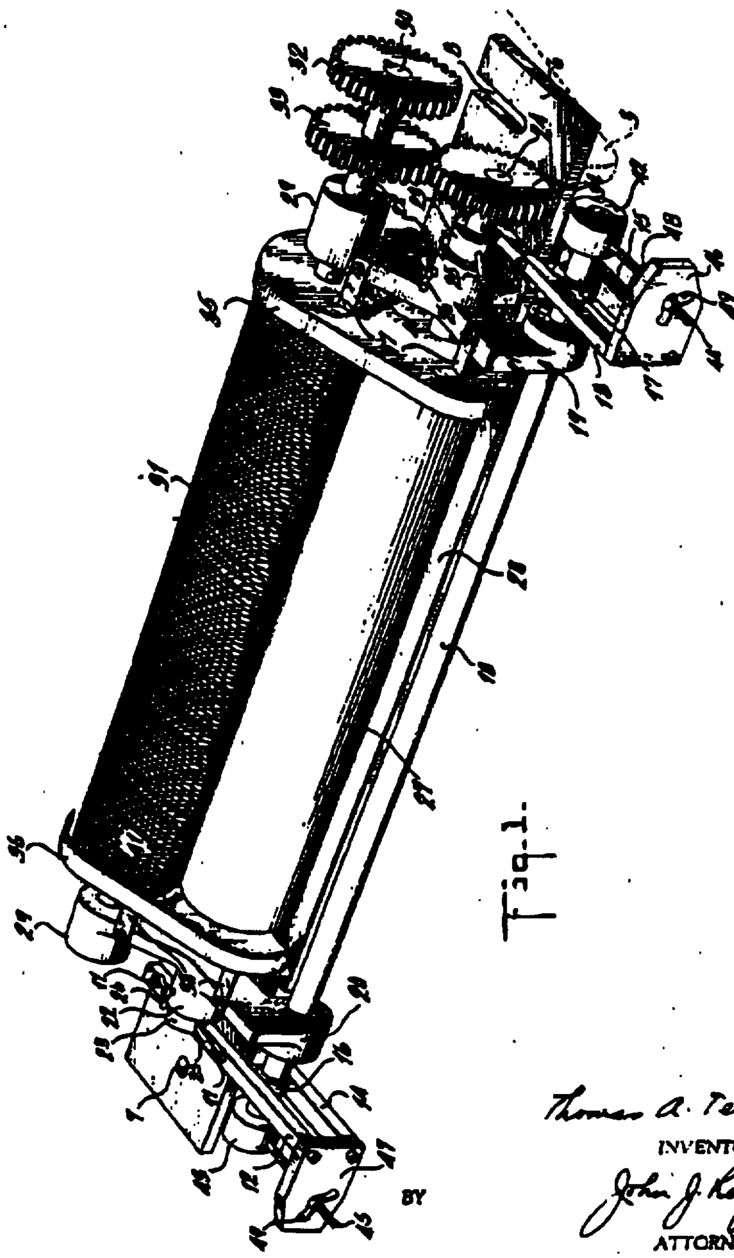

Fig. 1.

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Nov. 9, 1943. T. A. TERRY 2,333,962

INKING CONVERTER UNIT FOR JOB PRINTING PRESSES AND THE LIKE

Filed Nov. 2, 1940 6 Sheets-Sheet 2

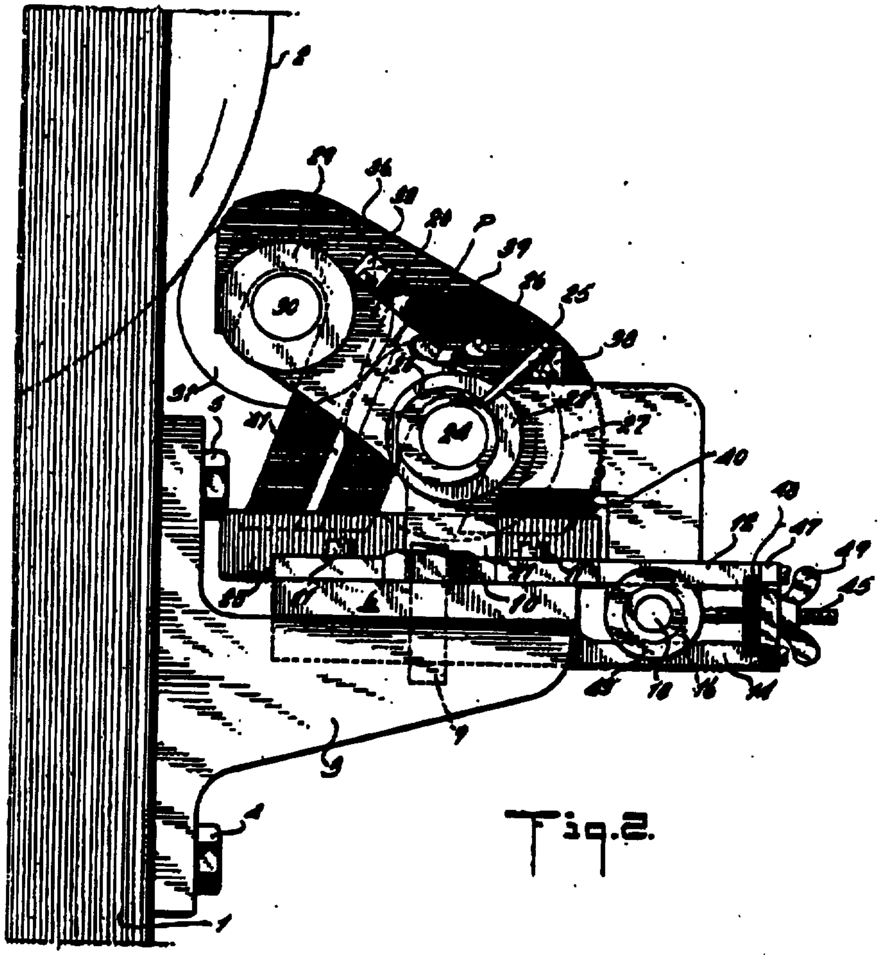

Fig. 2.

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Nov. 9, 1943. T. A. TERRY 2,333,962

INKING CONVERTER UNIT FOR JOB PRINTING PRESSES AND THE LIKE

Filed Nov. 2, 1940 6 Sheets-Sheet 3

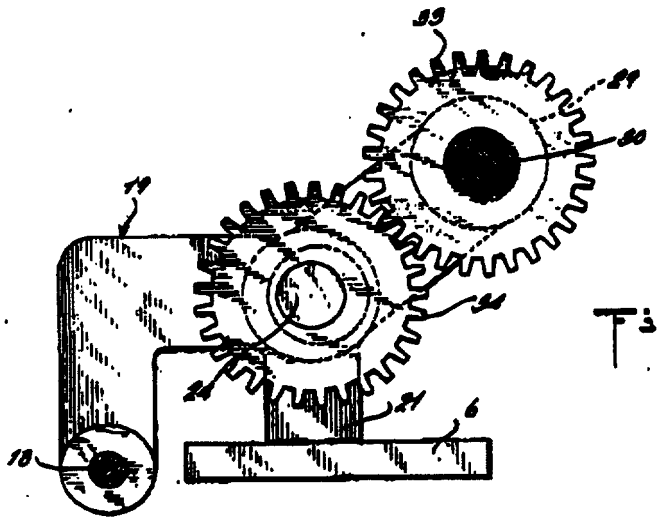

Fig.3.

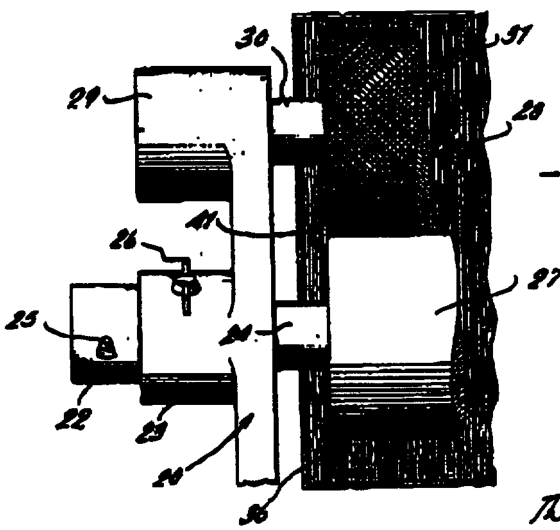

Fig.4.

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Nov. 9, 1943. T. A. TERRY 2,333,962

INKING CONVERTER UNIT FOR JOB PRINTING PRESSES AND THE LIKE

Filed Nov. 2, 1940 6 Sheets-Sheet 4

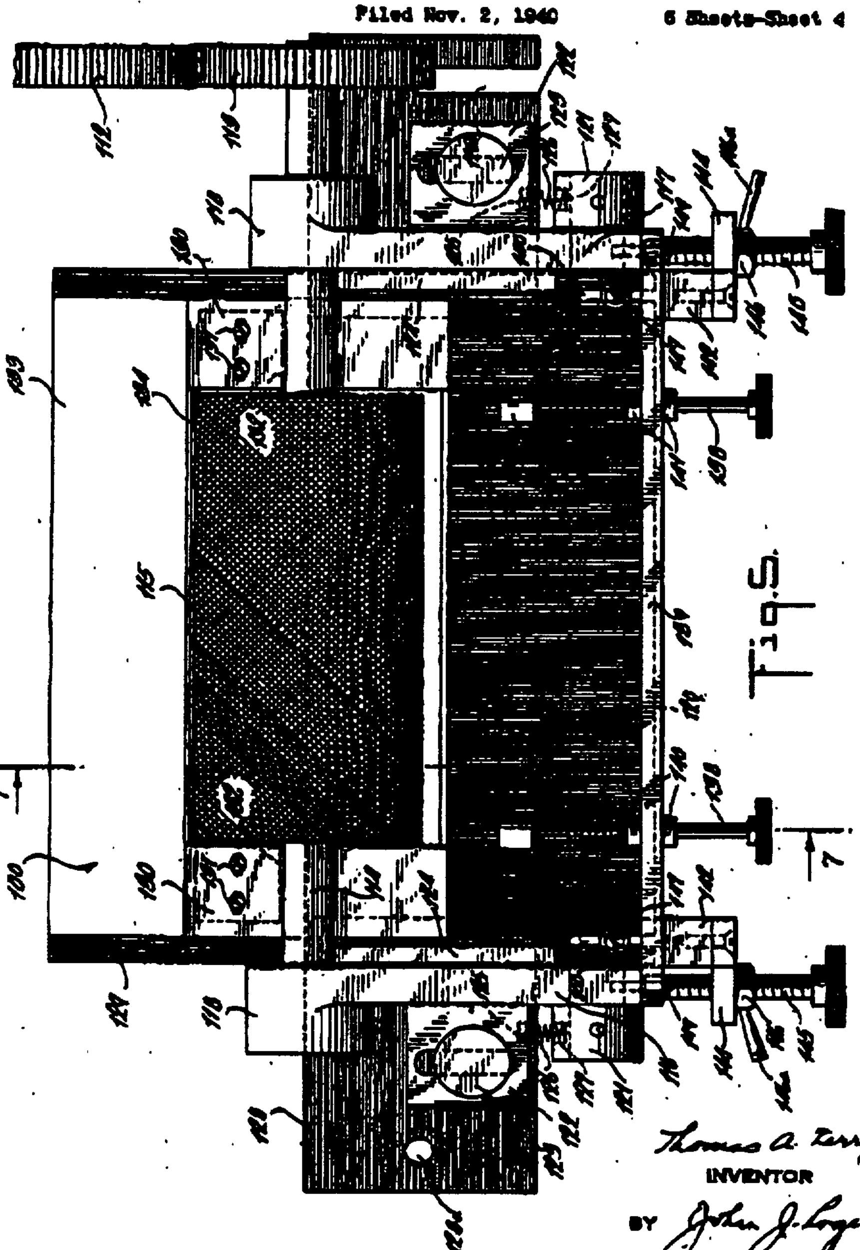

Fig. 5

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Nov. 9, 1943. T. A. TERRY 2,333,962

INKING CONVERTER UNIT FOR JOB PRINTING PRESSES AND THE LIKE

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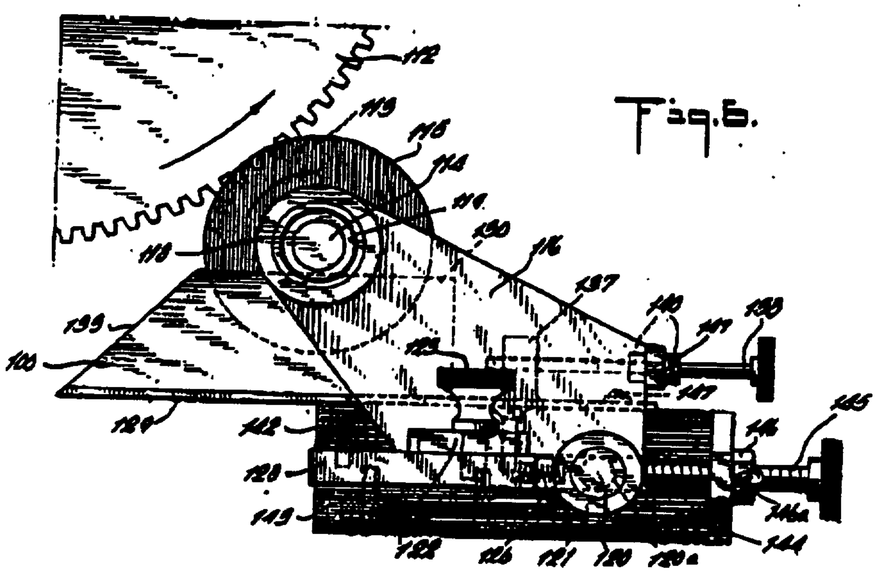

Fig. 6.

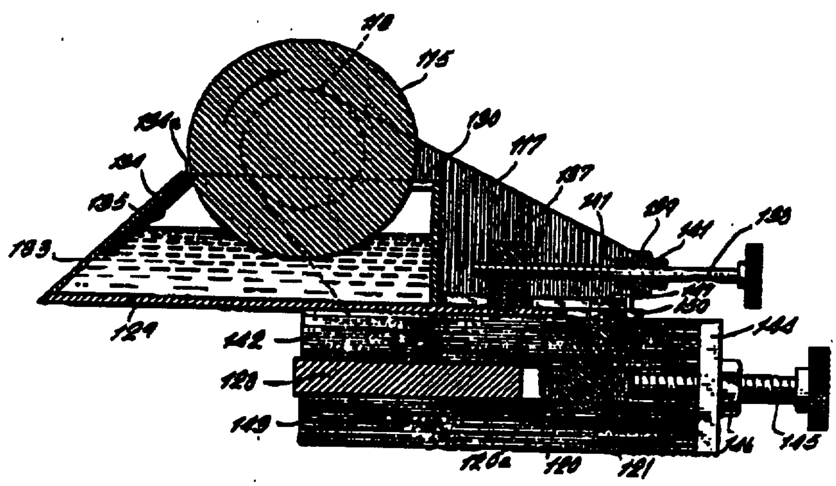

Fig. 7.

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Nov. 9, 1943. T. A. TERRY 2,333,962
INKING CONVERTER UNIT FOR JOB PRINTING PRESSES AND THE LIKE
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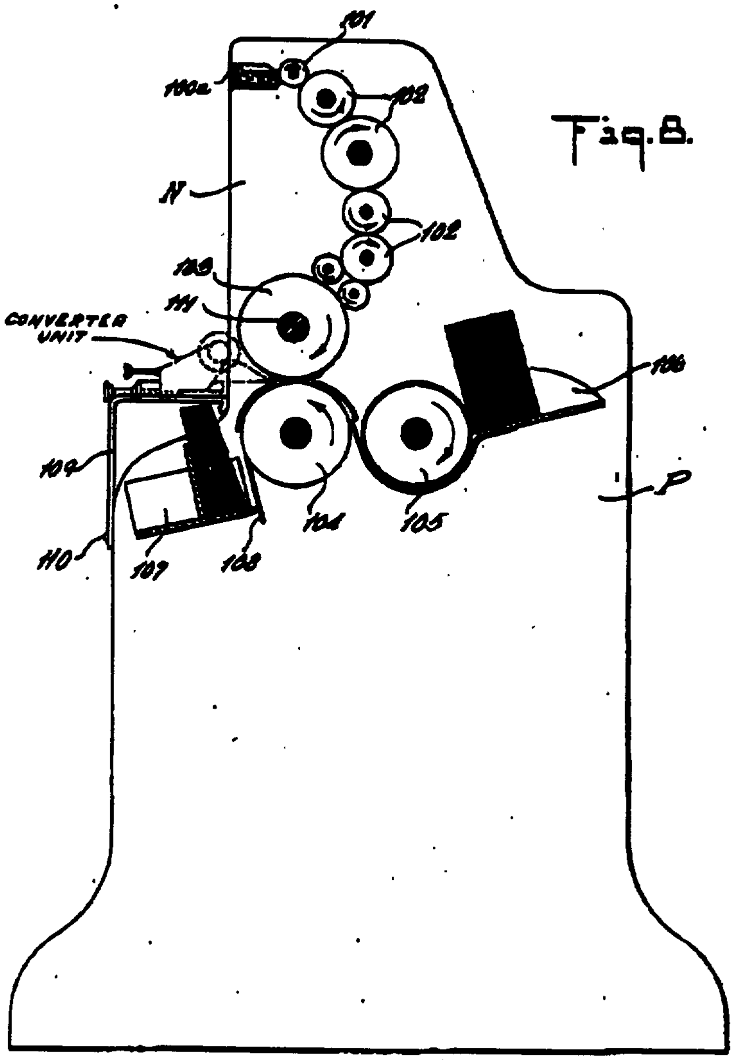

Fig. 8.

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Patented Nov. 9, 1943 2,333,962

UNITED STATES PATENT OFFICE

2,333,962

INKING CONVERTER UNIT FOR JOB PRINTING PRESSES AND THE LIKE

Thomas A. Terry, Brooklyn, N. Y.

Application November 2, 1940, Serial No. 363,961

4 Claims. (Cl. 101—351)

This invention relates to printing machines and more especially to a unitary attachment for converting printing presses of the ordinary printer's ink or oil ink type to presses employing ink of a volatile fast drying type.

Heretofore in printing machines of the job-printing type, it has been customary to employ so-called job-printing ink which, because of its chemical and physical characteristics including its high viscosity and low volatility, requires a complicated system of feed and applicator rollers for working the ink and transferring it from the fountain to the final printing roller in order to insure that the ink has the proper consistency and uniformity at the printing point. As an example of a typical press which involves such a conventional ink feed and roller construction, reference may be had to the press which is sold in the trade under the designation "Harris type P2" manufactured by the Harris Seybold Potter Company, of Cleveland, Ohio. Entirely apart from the relatively complex ink feed and roller structure of these conventional job-printing presses, is the fact that the finished work requires a comparatively long time for drying. In most cases, a delay of twenty-four hours is necessary before the printing ink is sufficiently dry so that the work can be used or transferred to another point for supplementary work such as folding or the like. Because of this great delay, the unit cost of printing with such machines is materially increased.

While various attempts have been made heretofore to adapt conventional job-printing presses to the use of fast drying inks, these attempts have not been successful because of the complicated ink feed roller arrangements which allows the volatile materials of the ink to dry out before reaching the printing roller. Furthermore in some cases it is desirable to be able to use such conventional job-printing presses either with jobber's ink or with fast drying inks. Accordingly, it is a principal object of this invention to provide a simple, cheap and highly efficient converter unit which can be readily attached to existing job-printing presses whereby such presses can be converted rapidly to operate with fast drying inks.

Another principal object of this invention is to provide an inking device whereby job-printing and the like can be effected with a printing ink which dries substantially immediately after application. I have found that with this new device, it is possible to execute nearly all forms of commercial job-printing with fast drying inks, which inks consist of a volatile solvent or vehicle such as an alcohol with the appropriate pigment therein. However, in order to use such inks commercially, it is necessary to design ink-feed and applicator arrangements so that the characteristics of such inks are fully taken advantage of.

Consequently a feature of the invention is to provide a novel and efficient ink-feed arrangement for printing presses whereby inks of the fast drying type may be efficiently employed.

Another feature relates to an ink-feed arrangement using inks having a volatile vehicle or solvent, whereby the pressure and adjustment of the various rollers can be made with the requisite accuracy in conformance with the physical characteristics of the ink.

Another feature relates to an ink-feed arrangement employing fast drying inks whereby a uniformly engraved metal roller of hard metal such as steel or the like is used to transfer the ink directly to the printing or type roller.

Another feature relates to an ink-feed arrangement for use with fast drying inks wherein a pair of ink-feed rollers are employed in closely adjusted relation, together with a special housing for the rollers whereby the lodging of excess ink between the rollers is substantially eliminated.

A further feature relates to an ink-feed arrangement wherein one of the ink-feed rollers is provided with independent adjustments at opposite ends whereby the quantity of ink transferred to a printing roller can be gauged in accordance with the closeness or openness of the printed subject matter at opposite margins or sections of the receiving surface.

A further feature relates to a unitary adaptor using fast drying inks designed for ready attachment to standard job-printing machines, wherein a single engraved ink-feed roller is mounted for adjustment to and from the printing or type roller of existing multi-roller job printers.

A further feature relates to an adaptor unit for expeditious attachment to existing multi-roller job printers wherein a specially designed ink roller is used in conjunction with a doctor blade to accommodate the physical and chemical characteristics of fast drying inks.

A still further feature relates to the novel organization, arrangement and relative location of parts which constitute a simple, improved and highly efficient unitary volatile-ink feeding adaptor for printing presses, whereby printing can be done with fast drying inks such as those containing a pigment in a volatile solvent or vehicle such as an alcohol or the like.

Other features and advantages not specifically enumerated will be apparent after a consideration

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of the following detailed descriptions and the appended claims.

In the drawings which show certain embodiments,

Fig. 1 is a perspective view of a unitary ink-feeding device of the dual roller type embodying features of the invention.

Fig. 2 is an end view of Fig. 1 showing the manner of attaching the device to a printing press.

Fig. 3 is an enlarged view of part of Fig. 1.

Fig. 4 is an enlarged view of another part of Fig. 1.

Fig. 5 is a top-plan view of another and preferred embodiment of the invention.

Fig. 6 is an end view of Fig. 5.

Fig. 7 is a sectional view of Fig. 5 taken approximately along the lines 7—7 thereof looking in the direction of the arrows.

Fig. 8 is a diagrammatic elevational end view of a typical job-printing press embodying the features of the invention.

Referring more particularly to Figs. 1 and 2, the numeral 1 represents the frame or spaced vertical uprights of any well-known form of printing press such for example as that known to the job-printing trade as the "Harris type F2" job printer. The printing or type roller 2 carrying the rubber printing plate, is driven in the direction of the arrow by the motor and gearing mechanism of the press which is of well-known construction. The unitary ink-feed adaptor according to the invention is adjustably supported on a pair of brackets 3 disposed at opposite sides of the printing machine and attached to the uprights 1 thereof, by suitable bolts 4, 5. The brackets 3 are spaced apart sufficiently to allow the inking attachment to be moved bodily as a unit into proper cooperative relation with type roller 2.

The inking arrangement comprises a flat metal main support 6 which has a hole 7 at one end and a slot 8 at the other end. Attached rigidly to each of the brackets 3 is a threaded pin 9, the left-hand pin 9 passing through the hole 7, while the right-hand pin engages in the slot 8 whereby the entire assembly can be swung around the left-hand pin and the longitudinal relation between the feed rollers and the type roller 2 can be readily adjusted. For this purpose, the nuts 10 are loosened and the support 6 which carries the inking arrangement is swung around pin 9 as a pivot whereupon both nuts 10 are tightened to fasten the assembly in adjusted position. Fastened adjacent the opposite ends of support 6 by means of screws 11, are two tracks or guides 12, 13. These guides are disposed above and in alignment with the guiding projections 14, 15, forming an integral part of the member 6. Members 12—14 and 13—15 thus define a guide track for the rollers 16 and 17 which are loose on shaft 18. Fastened adjacent opposite ends of shaft 18 are a pair of metal castings 19, 20, shown in an enlarged form in Fig. 3. Each of the members 19, 20, is provided with a downwardly extending lug 21 which has a smooth flat machined underface resting on and adapted to slide on member 6. Each member 19, 20, also carries an integral bearing bracket 22 which is provided with an eccentric opening to receive the rotatably adjustable bearing sleeve 23, in which the ends of shaft 24 are journalled. Affixed to each sleeve 23 is an adjusting handle 25 whereby the sleeves may be independently rotated to vary the position of the ends of shaft 24 with respect to shaft 18. After being properly adjusted, the sleeves 23 are locked in position by suitable wing-nutted set screws 26.

Rigidly fastened to shaft 24 is a fountain roller 27 which, in accordance with the invention, is of a smooth hard and impervious material such as polished metal or ceramic, and is adapted to rotate while partially immersed in the ink contained in the pan or reservoir 28 which is supported on member 6. Each of the members 19, 20, also has another integral bearing bracket 29 to receive the ends of shaft 30 to which is fastened the applicator roller 31 of hard metal such as steel or the like. In accordance with the invention, the roller 31 has its surface etched or engraved to provide a substantially uniformly reticulated surface. Preferably, the fineness of the engraving should on the average not exceed that corresponding to a 200 mesh screen and should not be coarser than that corresponding to a 100 mesh screen. I have found that by limiting the screen engraving within the above limits and by using the etched roller for the transfer of the quick drying ink to the printing or type roller, satisfactory results are obtained with fast drying inks of the type employing a volatile vehicle such as alcohol or the like. Preferably, the ink should be in the form of a pigment suspension in the solvent although it will be understood that it is within the compass of the invention to employ so-called colloidal solutions of pigment such as carbon-black, graphite, etc., in a volatile vehicle. A pigment ink that may be satisfactorily used is that sold under the trade name "Aniloх" by International Printing Ink Company. Roller 31 is driven by a gear 32 which in turn is driven in suitable timed relation to the gear which drives the type roller 2. Shaft 30 also has keyed thereto a gear wheel 33 which meshes with gear wheel 34 keyed to shaft 24. Preferably, the teeth of gears 33 and 34 are made long and deep enough so that they maintain their proper driving relation in all adjusted positions of roller 27.

Rollers 27 and 31 are provided with a protective housing comprising the end plates 35, 36, which are fastened by brackets 37, 38, to the associated members 19, 20, and a cover plate 39 is hinged to the end plates 35, 36, by suitable hinges 40. The said cover plate is removed in Fig. 1 to show the rollers 27 and 31 more clearly.

As will be seen from Figs. 2 and 4, the rollers 27 and 31 are in very close contact, and since the ink supply is of the fast drying type consisting of a pigment or pigments suspended or colloidably dissolved in an alcohol or similar vehicle, the ink is of relatively low viscosity. Since the rollers are rotating in the direction of the arrows (Fig. 2), the excess ink would tend to form a pool in the trough-like region P between the rollers. In order to prevent this accumulation of ink, the rollers have their flat ends in close proximity to and preferably in contact with the end plates 35, 36, as shown more clearly in Fig. 4. Each of said end plates is formed or provided with an inclined groove or channel 41 which extends upwardly beyond the region P between the rollers 27, 31, and also extend downwardly into the pan 28. I have found that by this arrangement excess ink is prevented from lodging between the rollers and is returned directly through channels 41 to the ink reservoir 28. In order to adjust the spacing relation between the transfer roller 31 and type roller 2, shaft 18 has fastened

thereto at its opposite ends the members 42, 43. Fastened to members 42, 43, are the threaded arms 44, 45, which pass through openings in the corresponding plates 46, 47 fastened to members 13—15, 13—14. The position of shaft 18 and consequently the position of the entire inking unit is adjustable by loosening the lock-nuts 48 and wing-nuts 49 whereby the positions of the ends of shaft 18 may be independently adjusted whereupon the nuts 48 and 49 may be tightened to lock the assembly in its adjusted position with respect to the type roller.

I have found that when inks of the fast drying type employing a volatile vehicle such as an alcohol are employed, very frequently it becomes necessary to adjust with precision not only the pressure between the impervious fountain roller 27 and the applicator roller 31, but also the pressure or spacing between the applicator roller 31 and the printing roller 2. Furthermore, it may be necessary in certain kinds of printed subject matter to have the pressure or spacing between the rollers different from one end to the other. For example, the margin on one side of the printed sheet or surface may have dense or close printing, while the other margin may have relatively open or little printing. Because of the low viscosity and high flowability of the fast drying inks, it is desirable under such circumstances to provide a greater quantity of ink at one end of the type roller. For this reason, the independent adjustments are provided for each end of roller 27 with respect to roller 31, this adjustment being effected by the independently adjustable eccentric bearing sleeves 28 at each end of shaft 26. Likewise, the independent adjustment for each end of the roller 31 with respect to the printing roller 2 is provided by members 44, 45.

Referring to Figs. 5 to 8, there is shown a preferred modification of Figs. 1 to 4 wherein the fountain roller 27 is provided with a specially designed doctor blade, and the manner of adjusting the various parts is somewhat modified. The unit according to this preferred embodiment comprises an ink box or fountain 100 having a bottom 129 which extends forwardly beyond the front wall of the box. The rear wall 133 of the box is inclined and has attached thereto the doctor blade 134 which, in accordance with the invention, is in the form of a vulcanized hard rubber strip of the order of hardness represented by 85 durometer. This doctor blade is rigidly clamped between the metal strip 135 and the wall 133 by screws so that the overhanging or effective lip 134a can be adjusted to take up for wear.

The extended bottom wall 129 has fastened thereto at opposite ends a pair of threaded posts 137 to receive the threaded shanks of corresponding adjusting screws 138. The ink box is supported on a flat main supporting member or bed plate 128 adapted to extend transversely across the front of the press adjacent the printing or type roller thereof. Bed plate 128 is provided with a perforation 128a at one end and a slot 128b at the other end whereby the entire unit can be removably attached to the frame of the printing press and whereby it can be pivoted around the pin or bolt which passes through the opening 128a so as to enable the unit to be cleaned or repaired without disturbing the press proper. Fastened in any suitable manner adjacent the ends of member 128 are flat metal bars 142, 143, which extend forwardly of the plate to define guide-ways for purposes to be described.

The ink box rests for adjustable sliding movement on the upper members 142 and is locked in adjusted position by means of locking screws 147 which pass through slots 150 in member 128. The engraved or etched ink transfer roller 115 is fastened to a shaft 114 which is mounted in suitable journal bearings in the brackets 118 provided with retaining hubs to prevent longitudinal displacement of the shaft. Ink transfer roller 115 is, in accordance with the invention, of a hard material such as polished steel having a reticulated surface formed by etching or engraving with an average fineness preferably not exceeding 200 mesh and an average coarseness not exceeding 100 mesh as described above in connection with Figs. 1 to 4. Preferably the etched depressions are uniform in cross section. Instead of using an etched steel roller, a similar hard impervious and smooth-surfaced roller such as vitreous, ceramic or the like may be employed, the surface of the roller being etched or engraved in any well-known manner.

A gear 113 is affixed to shaft 114 and is in mesh with another gear 112 which forms part of the same driving mechanism which drives the various ink-feed rollers of the press such as the rollers 101 to 105 (Fig. 5) so that the etched inking roller 115 of the converter unit operates in proper direction and timed relation with respect to the printing or type roller 103 of the press on which the usual rubber printing plate is fastened, the direction of rotation being indicated by the arrows.

The bearing brackets 118 form part of a frame consisting of the side members or castings 116, 117, which are united at their forward ends by the rigid cross arm 139 and by shaft 120. Member 139 is provided with two openings through which pass the ink box adjusting screws 138. The castings 116, 117, have laterally extending integral lugs 122, each of which is formed with a slot through which passes the lock-nut fastening screws 123, the ends of which are threaded into plate 128.

In order to guide the ink box during its adjustable sliding movement, and to prevent it from tilting, the castings 116, 117, have integral lips 124 which define with the adjacent members 142 a channel or track in which the lateral ends of the member 129 ride. The end portions of the ink box are provided with cover members 130 to the rear portion of which are adjustably fastened by screws 131 the rubber wipers 132. Wipers 132 engage the flat ends of the roller 115 to prevent ink being carried upwardly thereby.

For the purpose of adjusting the position of the etched transfer roller 115 with respect to the printing or type roller 103 (Fig. 8) of the press, there are provided at opposite ends of the unit two threaded adjusting screws 145 which pass through corresponding threaded openings in the lugs 144 carried by members 142 and 143. The screws 145 are locked in place by suitable lock-nuts 146 preferably provided with their own adjusting handles 146a. The ends of screws 145 are adapted to butt against the front flat edges of the castings 116 and 117. Each of the castings 116, 117, is provided with a lateral integral hub 121 to receive the round shaft 120. Shaft 120 therefore passes between the guide members 142 and 143 at opposite ends of the unit and at these portions the shaft 120 is reduced in diameter so as to prevent lateral displacement of the frame carrying the roller 115 with respect to the remaining parts of the unit. The frame and roller 115 are nor-

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mally urged to a forward position by means of a pair of compression springs 138 each of which has an end seated in a recess in the bed plate 120 and the opposite end seated in a corresponding recess in the hub 121.

With the foregoing arrangements, it is possible therefore to adjust the position of the ink box and therefore the position of the doctor blade 134a independently of the adjustment of the roller 115, while it is also possible to adjust the etched roller 115 and doctor blade and ink box as a unit. There is shown in Fig. 8 a diagrammatic side elevational view of a typical job-printing press of the type normally designed to employ a printing ink of low volatility such as the usual oil inks used in job printers. This type of press has the oil ink fountain 100a supported adjacent the top of the press frame. Located between the printing or type roller 103 are a series of ink working and distributing rollers 102 which are necessary in order to make sure that the ink from the fountain 100a has the proper consistency before it is actually applied to the type roller 103. Cooperating with the type roller 103 is an impression roller 104 and a feed roller 105 by means of which the envelopes or other blanks to be printed are carried from the inlet hopper 106 to the type roller and are discharged after printing into the receiving hopper 107. Presses of this general type are well-known in the art, of which the "Harris type F2" referred to hereinabove is typical. The converter unit of Figs. 5 to 7 is shown in dotted outline in Fig. 8 and the bed plate 120 of this unit is adapted to be removably fastened to a bracket 108 which is attached to the rear of the press by suitable bolts 110 so that the etched ink transfer roller 115 is in direct ink transfer engagement with the type roller 103.

By means of the single bed plate 120 which carries the entire unit, it is possible to attach this converter unit to existing presses in a very simple manner. When the bed plate 120 has been fastened, the nuts 146 are loosened and the screws 145 are turned so as to move the frame and etched roller 115 into proper relation with respect to the type roller 103. By means of the adjustments 145 at opposite ends of the unit, it is possible to regulate the pressure between the etched roller 115 and the type roller independently at opposite ends. When the roller 115 has been properly adjusted, the members 138 are adjusted causing the ink box and the doctor blade to move so as to provide the proper pressure between the edge 136a of the doctor blade and the edge cylinder 115. Here again by providing separate adjustments of each end of the unit, the pressure or clearances at the opposite ends of the doctor blade can be accurately regulated.

I have found that with arrangements such as those described employing the various individual pressure and spacing adjustments for the doctor member and the etched transfer roller, it is possible to use fast drying inks on the usual job-printing presses. I have also found that by using the inking arrangement as described, it is possible to effect job-printing with maximum speed since the ink dries substantially immediately. Furthermore, by using the particular arrangement and adjustment of parts as described above, sharper and more readily controlled printing may be effected and the machinery can be maintained in continuous use without clogging, a disadvantage which is always present with the ordinary job-printing press inks because such inks are of high viscosity and tackiness and relatively low volatility tend to accumulate dust.

The arrangement as described consists of a complete and self-contained unit which can be attached readily to a wide variety of presses. Furthermore, the arrangement provides the maximum in accuracy of adjustment and enables the entire unit to be pivoted or swung around the shaft 18 (Figs. 1-4) or around the axis of shaft 120 (Figs. 5-8) in a plane parallel to the axis of the printing roller, and also to be swung around an axis substantially perpendicular to the printing roller. This enables the inspection and operation of the printing to be readily supervised for repair, cleaning or the like.

It will be understood of course that various changes and modifications may be made in the particular embodiment disclosed without departing from the spirit and scope of the invention.

What I claim is:

1. A converter unit of the type described comprising a support for removable attachment to the frame of a printing press, an ink box slidably attached to said support, an ink transfer roller, a frame also slidably attached to said support and carrying said roller, a doctor blade fixedly mounted with respect to said box, means to adjust the transfer roller with respect to said box, and with respect to the printing roller, and means to adjust the doctor blade with respect to said transfer roller.

2. A converter unit according to claim 1 in which the means for adjusting the relation between the transfer roller and printing roller is independent of the means for adjusting the doctor blade with respect to the transfer roller.

3. A converter unit according to claim 1 in which the means to adjust the transfer roller with respect to the printing roller of the press includes a pair of springs located between said frame and said support normally tending to separate said transfer roller from said doctor blade, and a pair of adjustable stops carried by said support and engaging said frame to adjustably limit the spacing between the doctor blade and said single roller.

4. A unitary ink feeding assembly for attachment to a printing press of the type having a type roller, said assembly comprising an engraved polished metal inking roller, a flat main supporting member adapted to extend transversely across the front of the press, a rigid frame having lateral bearing supports for said roller and slidable toward and away from the press on said supporting member, an ink box movable as a unit with said frame, horizontal guides for said frame, and means to pivotally support said main supporting member with respect to the press adjacent one side thereof whereby said assembly can be swung through a horizontal angle for cleaning, inspection and the like.

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Nr. 319962 Nr. 319962

SCHWEIZERISCHE EIDGENOSSENSCHAFT
EIDGENÖSSISCHES AMT FÜR GEISTIGES EIGENTUM

PATENTSCHRIFT

Veröffentlicht am 30. April 1957

Klasse 48 d

Paul Heimlicher, Bern, ist als Erfinder genannt worden

HAUPTPATENT

Maschinenfabrik Winkler, Fallert & Co. AG, Bern

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Farbwerk für Buchdruck-, Offsetdruck- und dergleichen Maschinen für Farbendruck

Beim Druck von Tageszeitungen und Zeitschriften ist es für das bessere Hervorheben von einzelnen Annoncen wünschenswert, diese spaltenweise oder seitenweise in verschiedenen Farben drucken zu können, ohne dabei mehr als ein Farbwerk beanspruchen zu müssen. Zu diesem Zweck muß, wenn nicht besondere Einrichtungen vorhanden sind, beim Umstellen auf mehrere nebeneinanderliegende Farben das ganze Farbwerk sauber gereinigt werden. Das Reinigen der Farbwerkwalzen geht dabei sehr rasch und mühelos vor sich, da hierfür Apparate verwendet werden können, welche das Reinigen maschinell besorgen. Ganz anders verhält es sich mit dem Farbkasten. Dieser muß von Hand sauber von allen Spuren der vorhergehenden Farbe befreit werden. Die Unterteilung kann erst dann durch Einsetzen von Abteilwänden in den Farbkasten vorgenommen werden. Man hat daher nach Mitteln gesucht, das Reinigen des Farbkastens zu umgehen, indem man zusätzliche, komplette Farbkasten mit besonderen Duktoren und Farbmessern, oder komplette Pumpen, meist eine Seite breit, fest oder auswechselbar in die Maschine eingebaut hat. Diese Zusatzapparate übertragen dann ihre Farbe an anderer Stelle an die Farbwerkwalzen, als dies beim normalen Druck mit nur einer Farbe der Fall ist. Diese Zusatzaggregate haben verschiedene Nachteile. Einmal sind sie recht teuer, da sie die komplette Farbdosierungseinrichtung enthalten, wenn auch kleiner als die ohnehin für einfarbigen Druck vorhandene Einrichtung. Viele Inserenten wünschen nicht nur eine bestimmte Grundfarbe, sondern einen bestimmten Farbton, welcher oft mit der Verpackung des angepriesenen Artikels übereinstimmen muß. Daraus ergibt sich die Notwendigkeit, diese Zusatzapparate jeweils doch reinigen zu müssen oder aber eine ganze Menge solcher Apparate anzuschaffen. Die Montage der Zusatzapparate muß zudem recht genau sein, da von der Genauigkeit der Montage die Güte der Farbgebung abhängt. Das genaue Montieren der Zusatzapparate in stark verschmutzte Maschinen, vorgenommen durch mechanisch ungeschultes Personal, ist jedoch eine heikle Sache. Als weiterer Nachteil ist zu nennen, daß das Farbregulieren immer an diesen Zusatzapparaten selbst, also in der laufenden Maschine, vorgenommen werden muß, während an den Einrichtungen, welche für den Einfarbendruck ohnehin vorhanden sind, oft die Bequemlichkeit vorhanden ist, daß die Farbschrauben von außerhalb der Maschine aus bedienbar sind. Mit den erwähnten Zusatzapparaten geht somit diese Bequemlichkeit für den Farbendruck verloren.

Die Erfindung beseitigt diese Nachteile. Sie benützt eine Duktorwalze, die zur Führung der Teilfarbbehälter Rillen aufweist, die die Teilfarbbehälter an den Seitenwänden

halten, wobei sämtliche Teilfarbbehälter in einem größeren, um eine horizontale Achse verschwenkbaren Farbbehälter auswechselbar gehalten sind, welcher Farbbehälter an der dem Gelenk gegenüberliegenden Seite durch eine ausklinkbare Lasche in der Arbeitsstellung in solcher Höhe gehalten wird, daß eine genaue Trennung der Teilfarben gewährleistet ist.

Beigefügte Zeichnung stellt ein Ausführungsbeispiel des Erfindungsgegenstandes dar, und zwar zeigt:

Fig. 1 einen Querschnitt durch einen Teil des Farbwerkes, wenn es für Einfarbendruck eingerichtet ist,

Fig. 2 einen Querschnitt durch denselben Teil des Farbwerkes, wenn es für beispielsweise drei nebeneinander laufende, verschiedene Farben eingerichtet ist,

Fig. 3 einen Längsschnitt aus Fig. 2.

Zwischen den Maschinenwänden 1 und 2 ist Traverse 3 befestigt, welche Farbmesserbalken 4 mit den Farbschrauben 5 und Farbmessern 6 trägt. An Traverse 3 ist ferner Farbbehälter 7 um eine horizontale Achse schwenkbar befestigt und mittels Lasche 8 in Arbeitslage gehalten. Duktorwalze 9 mit Rillen 10 zur seitlichen Führung der Teilfarbbehälter taucht in den Farbvorrat 11. Bei ihrer Drehung in Pfeilrichtung nimmt sie die an ihr haftende Farbe mit, welche durch Farbmesser 6 teilweise, je nach Bedarf, abgestreift wird. Farbübertragungswalze 12 übernimmt die Farbe vom Duktor und gibt sie an die Farbwerkwalzen weiter. Wird Farbendruck gewünscht, beispielsweise drei Farben nebeneinander, dann wird der Farbvorrat 11 über Ventil 14 mittels rückwärtslaufender Pumpe und elastischer Schlauchverbindung rasch in den Vorratstank 15 abgelassen. Ohne besondere Reinigung und ohne besondere Vorsicht oder Genauigkeit werden darauf Teilfarbbehälter 16, 17 und 18 bei abgeschwenktem Farbbehälter 7 in denselben eingelegt. Nachdem der Farbbehälter 7 samt den Teilfarbbehältern 16, 17 und 18 wieder in Arbeitslage geschwenkt und die Duktorwalze 9 sowie die übrigen Farbwerkwalzen 12, 13 und das Farbmesser 6 gereinigt sind, können die gewünschten Farben 19, 20 und 21 in die Teilfarbbehälter 16, 17 und 18 eingefüllt oder die darin bereits von früheren Arbeiten noch enthaltene Farbe zum Drucken verwendet werden. Das Reinigen dieser Teilfarbkasten kann außerhalb der Maschine vorgenommen werden und gestaltet sich wegen ihrer Kleinheit und einfachen Form sehr mühelos. Statt die Teilfarbbehälter immer wieder zu reinigen, kann von den relativ billigen Teilfarbbehältern eine große Zahl vorrätig gehalten werden. Während des Druckens kann mit den gleichen Farbstellschrauben gearbeitet werden, ob nun einfarbig oder mehrfarbig gedruckt wird. Durch die ausklinkbare Lasche 8 wird der Farbbehälter 7 in solcher Höhe gehalten, daß eine genaue Trennung der Teilfarben gewährleistet ist.

PATENTANSPRUCH

Farbwerk für Buchdruck-, Offsetdruck- und dergleichen Maschinen, bei dem die Duktorwalze in den in Teilfarbbehältern enthaltenen Farbvorrat eintaucht und die regulierbaren Farbabstreifmesser oberhalb des Farbvorrates angebracht sind, dadurch gekennzeichnet, daß die Duktorwalze (9) zur Führung der Teilfarbbehälter (16, 17 und 18) Rillen (10) aufweist, die die Teilfarbbehälter an den Seitenwänden halten, und daß sämtliche Teilfarbbehälter in einem größeren, um eine horizontale Achse verschwenkbaren Farbbehälter (7) auswechselbar gehalten sind, welcher Farbbehälter (7) an der dem Gelenk gegenüberliegenden Seite durch eine ausklinkbare Lasche in der Arbeitsstellung in solcher Höhe gehalten wird, daß eine genaue Trennung der Teilfarben gewährleistet ist.

UNTERANSPRÜCHE

1. Farbwerk nach Patentanspruch, dadurch gekennzeichnet, daß der Farbmesserbalken (4) auf der die seitlichen Ständer verbindenden Traverse (3) einstellbar gehalten ist

und das Farbmesser (6) und die Farbschrauben (5) trägt.

2. Farbwerk nach Patentanspruch und Unteranspruch 1, dadurch gekennzeichnet, daß der Farbbehälter (7) mit einem Vorratstank (15) durch eine elastische Schlauchverbindung mit Hahn und Pumpe verbunden ist.

Maschinenfabrik
Winkler, Fallert & Co. AG
Vertreter: Naegeli & Co., Bern

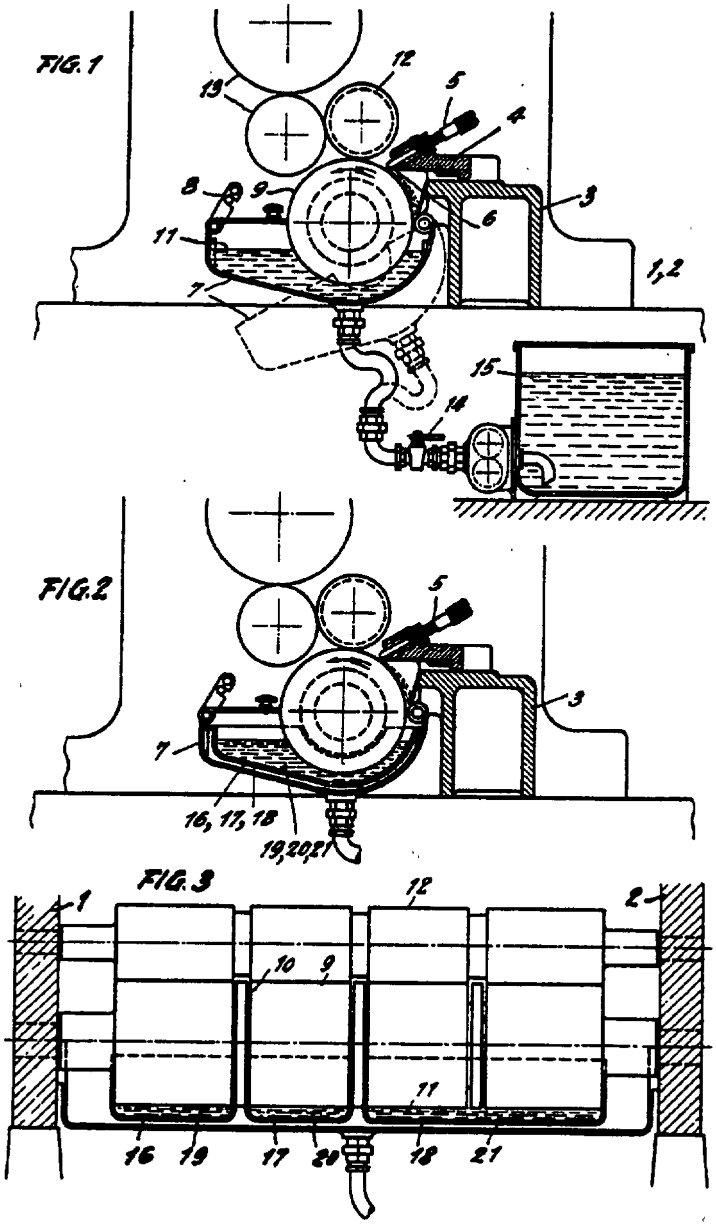
FIG. 1
13
12
5
4
8
9
3
6
11
1,2
7
15
14
FIG. 2
5
3
7
16, 17, 18
19, 20, 21
FIG. 3
1
12
2
10
9
11
16
19
17
20
18
21

5

PATENT SPECIFICATION

DRAWINGS ATTACHED

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International Classification:—B41f.

COMPLETE SPECIFICATION

Improvements in or relating to Ink Supplying Means for Rotary Printing Machines

I, ERNEST ARTHUR TIMSON, a British Subject, of 75, Northampton Road, Kettering, Northamptonshire, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to ink supplying mechanisms for rotary printing machines, and has reference to such mechanisms of the class including a trough, technically known as a "duct" or "fountain", to contain ink, and a duct or fountain roller so arranged as to pick up ink from this trough and to transfer same, through the medium of a transfer roller, to an inking drum.

The invention moreover, concerns particularly such inking mechanisms of the kind wherein the bottom of the duct is constituted by an adjustable doctor blade having its leading edge set on to the duct roller to control the amount of ink picked up thereby, and the back of the said roller forms and closes the otherwise open front of the duct.

As well known to those acquainted with the art concerned, when a duct roller is required to transfer to an inking drum axially separated bands of differently coloured inks for multi-colour application, it is necessary to divide the duct up transversely into a plurality of separate compartments to contain inks of respectively different colours. Such a division of a duct is customarily effected by duct dividers each of which is in the nature of an appropriately shaped vertical partition arranged to extend perpendicularly with respect to the axis of the duct roller, and has combined therewith means for making a liquid-tight seal not only between its underside and the top surface of the doctor blade but also between a concave front edge thereof and that back portion of the duct roller which forms and closes the front of the duct.

Now heretofore these liquid tight seals have been made by strips of yieldable material, such as felt, rubber or plastic which have been forcibly deformed and pressed down upon the doctor blade and forwardly on to the back of the duct roller by means of screws. Thus, the lower straight edges and the forward concave edge of prior duct dividers are usually channelled or grooved to receive the strips of yieldable sealing material, and at least portions of the dividers are hollowed out to receive screws which are adapted to be screwed through solid portions of these dividers suchwise as to impinge against and deform the sealing strips into contact with the doctor blade and the duct roller.

But the deformation of resilient strips by means of screws, apart from involving tedious adjustments, does not, by virtue of the "fixed adjustment" effect, provide very satisfactory liquid-tight seals.

The object of the present invention is to provide an improved duct roller designed to obviate the use of deformable strips and screws and in this regard adapted to provide, in a simpler manner than heretofore, more efficient liquid-tight seals between the doctor blade and the duct roller, as will be hereinafter described.

According to this invention a closed tubular sealing element or elements made of an expansible resilient material is or are arranged to extend along the appropriate edges of a duct divider, and there are provided in association with the latter, means enabling the said element or elements to be inflated or distended by a fluid pressure medium to an extent sufficient to ensure the required liquid-tight seals.

Although separate inflatable or distendable

[*Price 4s. 6d.*]

W019042

sealing elements may be arranged along the straight lower and front concave edges of the improved duct divider, it is primarily the intention that a single element shall extend right along both of these edges. In the further following description it will accordingly be assumed that there is only one inflatable or distendable sealing element to each duct divider, without, however, any limitation in this respect.

In order that the invention may be more clearly understood and readily carried into practical effect, a specific example of the improved duct divider embodying the foregoing and other features of the invention will now be described with reference to the accompanying diagrammatic drawing, wherein:—

Figure 1 is a side view of the said duct divider shown in relation to the duct roller and the adjustable doctor blade, and

Figure 2 is a detail vertical sectional view taken on the line 11—11 of Figure 1.

Referring to the drawing, the reference numeral 1 indicates the back of the duct of an ink supplying mechanism of the kind herein referred to. The duct roller arranged to pick up ink from the duct is indicated at 2. The bottom of the duct is constituted in the usual way by a flexible doctor blade 3 which is adjustable. The leading edge 3a of this blade 3 is set on to the duct roller 2 to control the amount of ink picked up thereby. The back of the roller 2 forms and closes the front of the duct.

In the drawing, one of the plurality of duct dividers by means of which the duct is divided up transversely into a plurality of separate compartments to contain ink of respectively different colours is represented at 4. As will be seen more clearly in Figure 2, each of such dividers 4 (of which only one is shown) consists of a vertical partition which extends perpendicularly with respect to the axis *a* of the duct roller. The bottom edge 4*a* of the divider 4 is downwardly sloped to correspond to the downward inclination of the doctor blade 3; its front edge 4*b* is made concave to conform with the duct roller 2; its back edge 4*c* is vertical to oppose the vertical back 1 of the duct, and its horizontal top edge 4*d* is straight from end to end.

In accordance with the characteristic feature of the present invention a closed tubular sealing element 5 of an expansible resilient material is arranged to extend continuously along the front, bottom and back edges 4*b*, 4*a* and 4*c* of each duct divider 4. The closed tubular sealing element 5 may advantageously consist of a length of O-tubing closed at its opposite ends. Preferably, the said element is made of a suitable rubber, plastic or equivalent expansible resilient material which is resistant to oils or solvents incorporated in printing inks.

The rear end of the tubular sealing element 5 has secured therein, in a gas or liquid-tight manner, a plug 6 or a tube furnished with a nipple or valve 7 adapted for the admission therethrough into the element of a fluid pressure medium by means of which the element is caused to dilate to an enlarged size and thus enable it to contact and make a good liquid-tight seal on the top surface of the doctor blade 3, at the back portion of the duct roller 2 which forms and closes the front of the duct, and on the vertical back 1 of the said duct.

The fluid pressure medium employed to effect inflation of the closed tubular sealing element 5 of each duct divider 4, after the manner of blowing up an inflatable ball, cushion or tyre, may be air or any other suitable gas. It is, however, also within the scope of the invention to effect distention or dilation of the said sealing element by a liquid pressure medium, such as oil.

Non-return valve means of any suitable character, preferably operable to permit of the release of fluid pressure medium from the sealing element 5 and consequent deflation of the latter as occasion may demand, may be directly combined with the inlet plug or tube. In this instance, each duct divider 4 of a series set into position to split a duct up into the desired number of compartments may be individually inflated or dilated by the application of a pressure gun to the nipple or valve provided in or on such divider.

Alternatively, sealing elements combined with a series of duct dividers may be connected up to a common source of pressure medium in which case a single valve common to all of the dividers may be provided either in direct association with the duct or at a more remote location.

In any event the leading end of the sealing element 5 of each duct divider 4 may conveniently be closed by a solid plug 8.

The inflatable or dilatable sealing element 5 of each divider 4 is, in the illustrated example, secured within an accommodating channel or groove 9 formed in the edges 4*a*, 4*b* and 4*c* of the divider, the outer rounded side of the element initially protruding from the divider.

As will be appreciated, when a duct divider has been correctly set in position on the doctor blade 3 and closely adjacent to the back of the duct roller 2, the admission of fluid pressure medium into the sealing element 5 will cause the latter to swell or distend by inflation or dilation, into firm and uniform and yet yieldable, sealing contact both with the upper surface of the doctor blade (as shown in Figure 2) and the back of the roller as indicated at 2*a* in Figure 1.

Where, as may be, the inner side of the tubular sealing element 5 has formed therein a hole in which is secured an inlet tube then the latter may be accommodated in a recess

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formed in the body of the improved duct divider.

WHAT I CLAIM IS:—

1. In or for a duct of an ink supplying mechanism of the class herein referred to for a rotary printing machine, an ink divider for the purpose specified, wherein a closed tubular sealing element or elements made of an expansible resilient material is or are arranged to extend along the appropriate edges of the divider, and means are provided enabling the said element or elements to be inflated or distended by a fluid pressure medium to an extent sufficient to ensure the required liquid-tight seals.

2. An ink divider according to Claim 1, wherein the or each closed tubular sealing element consists of a length of O-tubing closed at its opposite ends.

3. An ink divider according to Claim 1 or 2, wherein the or each tubular sealing element is made of a suitable rubber or resilient plastic which besides being expansible is resistant to oils or solvents incorporated in printing inks.

4. An ink divider according to Claim 1, 2 or 3, wherein a single closed tubular sealing element is arranged to extend continuously along a straight lower edge and the front concave edge of the divider.

5. An ink divider according to any of the preceding claims, wherein an appropriate portion of the or each tubular sealing element has secured therein, in a gas or liquid-tight manner, an inlet plug or a tube furnished with a nipple or valve adapted for the admission therethrough into the element of a fluid pressure medium.

6. An ink divider according to any of the preceding claims, wherein the or each closed tubular sealing element is blown up with air or any other suitable gas.

7. An ink divider according to Claim 5, wherein a non-return valve, operable to permit of the release of fluid pressure medium from the or each sealing element as occasion may demand, is combined with the inlet plug or tube.

8. In or for an ink supplying mechanism of the class herein referred to for a rotary printing machine, a duct fitted with a series of duct dividers as claimed in any of Claims 1—7 and arranged to split the duct up into a plurality of compartments, each divider being individually inflatable or dilatable by the application of a pressure gun to its nipple or valve.

9. In or for an ink supplying mechanism of the class herein referred to for a rotary printing machine, a duct fitted with a series of duct dividers as claimed in any of Claims 1—4 or 6 and arranged to split the duct up into the desired number of compartments, said dividers being connected up to a common source of pressure medium and a single valve common to all the dividers is provided either in direct association with the duct or at a more remote location.

10. An ink divider according to any of the preceding claims, wherein the or each inflatable or dilatable sealing element is secured within an accommodating channel or groove formed in the relevant edge or edges of the divider, the outer rounded side of the element initially protruding from the divider.

11. In or for a duct of an ink supplying mechanism of the class herein referred to for a rotary printing machine, an ink divider adapted to provide liquid-tight seals between a doctor blade and a duct roller substantially as herein described with reference to the accompanying drawings.

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Agents for the Applicant.

Leamington Spa: Printed for Her Majesty's Stationery Office by the Courier Press.—1963.
Published at The Patent Office, 25, Southampton Buildings, London, W.C.2, from which copies may be obtained.

924401 COMPLETE SPECIFICATION
1 SHEET This drawing is a reproduction of the Original on a reduced scale

Fig.1.

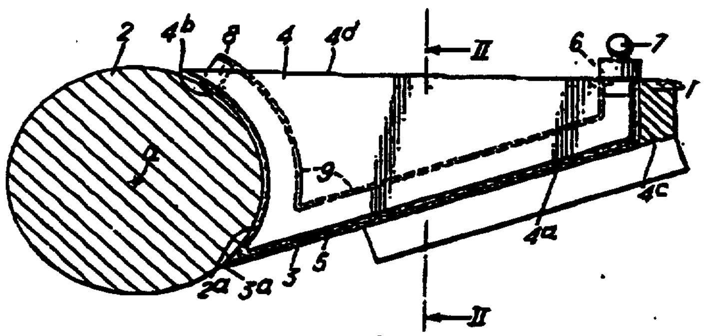
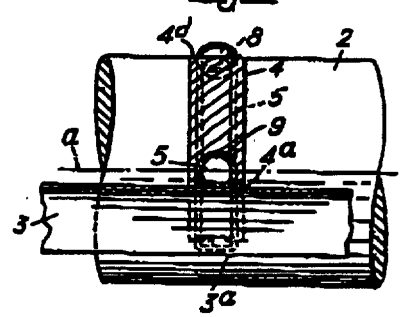


Fig.2.



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Aug. 20, 1968 J. DE LIGT 3,397,675

COATING APPARATUS

Filed March 13, 1967

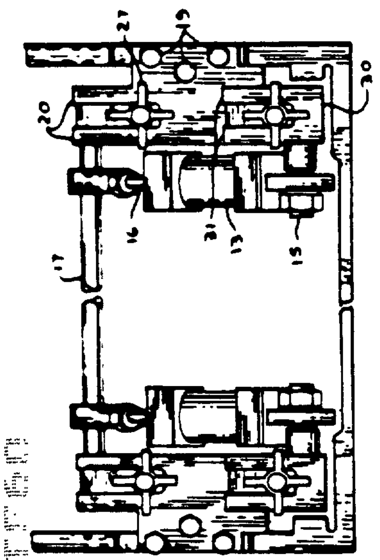

Fig. 2

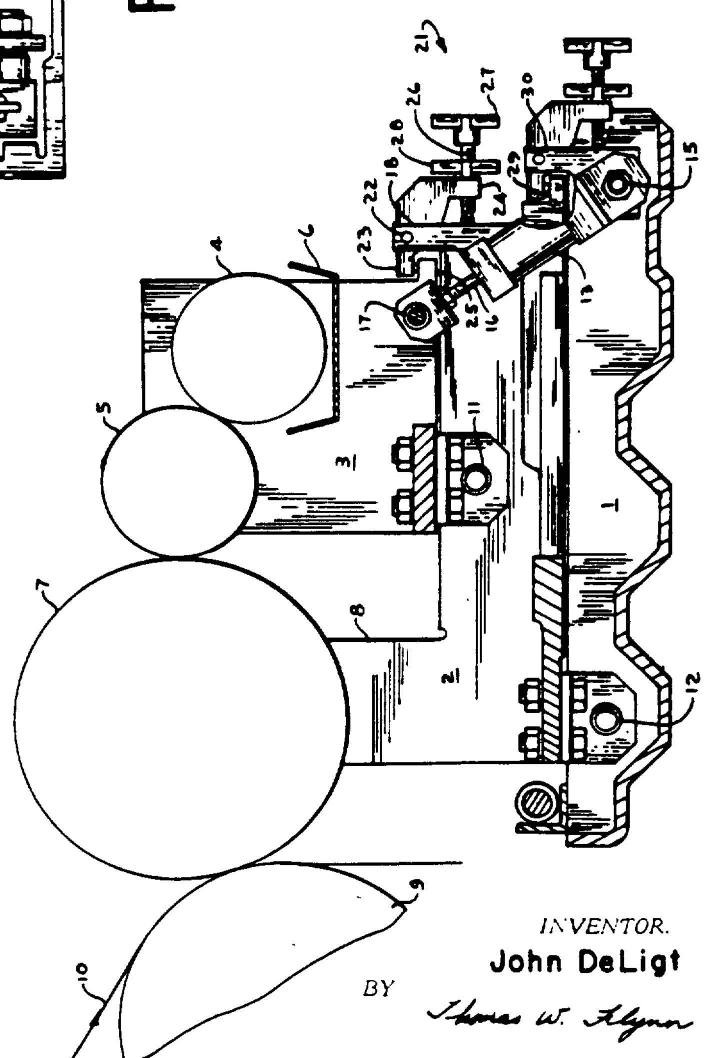

Fig. 1

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W019047

United States Patent Office 3,397,675
Patented Aug. 20, 1968

3,397,675

COATING APPARATUS

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Filed Mar. 13, 1967, Ser. No. 622,691
3 Claims. (Cl. 118—258)

ABSTRACT OF THE DISCLOSURE

A coating or printing station having its applicator and transfer rolls attached to pivotally mounted supporting frames so that the rolls may be moved into and out of operative position. Adjustable, lost motion stops are provided interconnecting the supporting frames so that the frames may be pivoted serially by means of a single source of power and the operative positions of the rollers preset by adjusting the stops.

BACKGROUND OF THE INVENTION

Field of the invention.—Actuating systems for moving the rollers of a rotary coater or printer into and out of operative positions.

Description of the prior art.—In a conventional form of rotary coater or printer, the coating material is picked up from a supply tray or pan by a pickup roll and distributed by the pickup roller over the surface of a transfer roller. The transfer roller then transfers a layer of coating to an applicator roll which applies the coating to a web of material carried past the applicator roller by a backup roll.

In practice, the pickup and applicator rolls may be resiliently surfaced and the transfer roll provided with a relatively hard etched surface. Depending upon the surface configuration of the applicator roll, the coating may be applied to the web in either a continuous or patterned layer. In this regard it should be noted that the terms coater, coating and the like are used herein in their generic

In this type of operation it is necessary to maintain a continuous layer or coating.

In this type of operation it is necessary to maintain a desired pressure or spacing, between the web being treated and the applicator roll and between each of the rolls. It is also desirable to be able to withdraw the applicator roll from the web and at least the transfer roll from the applicator roll when the coating operation is temporarily discontinued and to return the rolls to exactly their former positions when coating is again commenced. Additionally, it is necessary that these pressures or spacings be capable of adjustment to suit the requirements of specific operations.

In a known form of actuating system intended to accomplish these results, the frames for the applicator and transfer rolls are each mounted on trackways and an eccentrically mounted shaft, actuated by a hydraulically powered linkage system, is provided for each frame to slide the frames along their respective trackways and thereby move the rolls into and out of their operative positions.

It will be apparent that in this type of actuating system the contacting portions of the frames and trackways must be finished with precision and maintained in this condition to insure a smooth sliding action. It will also be apparent that the provision of separate, hydraulically actuated linkages and eccentrically mounted shafts for each frame will be both relatively expensive to construct and a ready source of malfunction.

Of equal importance, it has been found that some degree

of play is almost inherent in this type of actuating system and that, almost invariably, when the frames are moved into operative position after a temporary discontinuance of the coating operation, the pressures or spacings between the rolls and the web, which had been set before discontinuance of the operation, have changed. Hence, upon resumption of coating it is usually necessary to readjust the positions of the rollers until an acceptable coating on the web being treated is obtained. Not only does this result in lost production time, but the web and coating material used in making these adjustments are wasted.

SUMMARY

In accordance with the present invention an actuating system is provided which permits the applicator and transfer rolls to be set to their desired operating pressures or spacings. When it becomes necessary to stop the coating operation, the frames on which the rolls are mounted are pivoted rearwardly, withdrawing the rolls from the work piece.

Upon resumption of coating, force is applied directly to the transfer roll frame causing it to tilt forward and move the transfer roller evenly toward the applicator roll. An adjustable, lost motion stop engages the transfer roll frame when the transfer roll has moved to the spacing or pressure value with the applicator roll which had been maintained before interruption of the coating operation. When the transfer roller has been moved to its desired position with respect to the applicator roll, continued application of force to the transfer roll frame is transmitted through the stop member to the applicator roll frame causing this frame to tilt forward about its pivot and carry the applicator roll towards the work piece. A second, adjustable, lost motion stop mounted on the base frame then engages the applicator roll frame when that frame has pivoted to a position such that the applicator roll is brought into its desired position with respect to the workpiece.

The two stops and the force applied to the transfer roll frame then serve to maintain the frames, and the rolls carried thereby, in their operative positions until it is again desired to discontinue the coating operation at which time the force applied to the transfer roll frame is relaxed and the frames allowed to pivot rearwardly and withdraw the rolls from their operative positions.

It will be seen that with the present apparatus the need for precision finished trackways is eliminated.

It will also be seen that by pivoting the frames rather than sliding them, the frames are always moved evenly into and out of position and the danger of the rolls becoming skewed is obviated.

It will also be seen that force need only be applied to the transfer roll frame since that force is also transmitted through the stop members to the applicator roll frame Thus, the need for separate actuating systems for each roll is eliminated.

Additionally, through the use of pivoted frames and adjustable stops not only are the rather complicated, dual actuating systems replaced, but the rolls are precisely placed in their desired positions with respect to each other and the workpiece.

Further, by use of the lost motion stops, the rolls are moved serially into their respective positions by a single continuous application of force. Thus, the transfer roller is first moved into its desired position with respect to the applicator roll, causing coating to be transferred thereto, then the entire assembly of rolls is moved as a unit until the applicator roll is in its desired position and coating the workpiece.

These and other objects and advantages will become more readily apparent from the following description.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1 is a vertical cross-sectional view through a printing or coating station embodying principles of the present invention; and

FIGURE 2 is a rear elevational view thereof.

DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference to FIGURE 1, it will be seen that the coating or printing station comprises a base frame **1**, an applicator roll frame **2**, and a transfer roll frame **3**. Both sides of the printing or coating station are identical and in the following description one side only will be described; it being understood that the opposite side thereof is the same as that described.

Frame **3** carries a pickup roll **4** and a transfer roll **5**, rotatably mounted thereon, with the lower portion of the pickup **4** rotating in a pan or tray **6**, which will contain a supply of the coating material.

Applicator roll frame **2** is of substantially reversed L-shape, as seen in FIGURE 1, and carries the applicator roll **7** rotatably mounted between its upright legs **8**. Positioned adjacent the applicator roll **7** is a backup roller **9**, which carries a web **10** of the material to be treated past the printing or coating station. Frame **3** overlies frame **2** and is pivotally attached thereto, as at **11**, and frame **2**, in turn, is carried by the base frame **1** and is pivotally attached thereto, as at **12**, with the axes of all rollers and pivot points parallel to each other.

Adjacent the rear end of frame **1** a cylinder **13** is pivotally attached, as at **15**, and slideably receives a piston carrying a piston rod **16**, which in turn, is pivotally attached at its outer end to frame **3** by means of a pivot shaft **17** extending between opposite sides of the frame.

As seen in FIGURES 1 and 2, a clevis member **18** is fixed to the rear end of frame **2**, by bolts **19** or the like, and has upstanding, spaced, parallel legs **20**. An adjustable, lost motion stop **21** is positioned between the upstanding legs **20** of the clevis and is pivotally attached thereto, as at **22**. The stop **21** comprises a substantially horizontally extending leg **23** and a substantially vertically extending leg **24**, with the leg **23** overlying a rearwardly projecting shoulder **25** of the frame **3**. A threaded adjusting member **26** extends through the leg **24** of stop **21** and has a handle **27** for moving the adjusting screw **26** inwardly and outwardly of the leg **24**. A lock nut **28** is also provided for locking the adjusting member **26** in position.

Frame **2** is also provided with a rearwardly extending shoulder **29**, and, attached to the rear end of base frame **1** is a second clevis member **30**, having upstanding legs **31**. An adjustable lost motion stop member **21**, identical to that described above, is also provided, pivotally mounted between the upstanding legs **31** of clevis **30**.

In its inoperative position, frame **2** wil be resting on frame **1** and frame **3** will be resting on frame **2** with the lower surface of arm **23** spaced from the upper surface of shoulder **25** and the upper surface of shoulder **29** spaced from the lower surface of the leg **23** adjacent thereto. In this position, roll **5** will be spaced from roll **7**, and roll **7** will be spaced from roll **9** and the web **10** of material carried thereby. The spacing between shoulders **25** and **29** and the respective legs **23** of adjacent stops **21** will be determined by the extent to which the adjusting members are threaded through the legs **24** of the stop members.

With the components of the coater in their inoperative positions, as described above, when it is desired to resume the coating operation, cylinder **13** is pressurized, causing the piston **16** to extend outwardly thereof. This will cause the frame **3** to pivot about point **11** until the upper surface of the shoulder **25** engages the lower surface of adjacent leg **23**. At this point the axes of rolls **5** and **7** will be in their desired positions with respect to each other.

Continued extension of the piston **16** from the cylinder **13** will cause the pivoting force applied to the frame **3** to be transmitted by the shoulder **25** and stop member **21** to the frame **2**; causing this frame to pivot about point **12**. Frame **2** will then pivot about point **12** until the upper surface of its shoulder **29** contacts the lower surface of the adjacent overlying leg **23**. At this point, the axes of rollers **7** and **9** will be at their desired spacing and coating or printing will be applied to the web **10**.

The rollers **7** and **5** will remain in their operative positions as long as sufficient pressure is maintained in the cylinder **13**. When it is desired to temporarily discontinue the coating operation, the pressure in cylinder **13** is relaxed and the frames **2** and **3**, and the rolls **7** and **5**, respectively, are allowed to move rearawrdly to their inoperative positions. When it is again desired to commence coating, the cylinder **13** is once again pressurized and the rollers **7** and **5** move, as described above, into their former positions.

It will be seen that because the movement of frames **2** and **3** is a pivotal motion, the rolls **7** and **5** mounted thereon will always move with their axes parallel to the original positions thereof and skewing of the rolls is obviated. Additionally, since the stops **21**, locked in position by the lock nuts **28**, provide a positive stop between adjacent frames, the rolls, when tilted forward, will always move into exactly the same position they occupied prior to interruption of the coating operation.

Thus, not only does the present invention eliminate the complicated dual actuating system of the prior art, but a system is provided which insures that the rolls will be positively moved into and out of their operative positions.

While a preferred embodiment of the invention has been described for purposes of illustration, it will be apparent that modifications thereof will occur to those skilled in the art within the scope of the appended claims.

I claim:

1. A coating or printing station comprising:

(a) a base frame,

(b) a substantially L-shaped frame overlying said base frame and pivotally attached to said base frame adjacent the intersection of the legs of said L-shaped frame,

(c) an applicator roller rotatably mounted between the upstanding legs of said L-shaped frame,

(d) a transfer roller frame overlying said L-shaped frame and pivotally attached thereto,

(e) a transfer roller rotatably mounted on said transfer roller frame,

(f) the axes of said rollers and the pivotal connections being substantially parallel,

(g) a first clevis member having a pair of spaced upstanding legs mounted on said base frame,

(h) a first L-shaped member pivotally mounted between said legs of said first clevis with one leg of said first L-shaped member extending substantially horizontally in spaced relation to a rearwardly projecting shoulder on said L-shaped frame and the other leg thereof extending substantially vertically in spaced relation to said base frame,

(i) an adjusting screw threaded through said vertically extending legs of said first L-shaped member and bearing at one end against said base frame,

(j) a second clevis member having a pair of spaced upstanding legs mounted on said L-shaped frame,

(k) a second L-shaped member pivotally mounted between said legs of said second clevis with one leg of said second L-shaped member extending substantially horizontally in spaced relation to a rearwardly projecting shoulder on said transfer roller frame and the other leg thereof extending substantially vertically in spaced relation to said L-shaped frame,

(l) an adjusting screw threaded through said vertically extending leg of said first L-shaped member and bearing at one end against said L-shaped frame,

(m) a cylinder pivotally attached at one end to said base frame, and

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(n) a piston slideably received in said cylinder and having a piston rod pivotally attached to said transfer roll frame.

2. A coater or printing station comprising:

(a) a first pivotally mounted frame having a roll rotatably mounted thereon,

(b) a second pivotally mounted frame having a roll rotatably mounted thereon,

(c) the axes of said rolls and the pivotal connections of said frames extending in parallel relationship to each other,

(d) a first lost motion stop mounted on said first frame and comprising:

(i) a clevis having a pair of spaced legs,

(ii) a substantially L-shaped member pivotally mounted between said clevis legs with one leg of said L-shaped member overlying a portion of said first frame and the other leg of said L-shaped member overlying a portion of said second frame, and

(e) means for applying a pivoting force to said second frame.

3. The apparatus of claim 2 further comprising:

(a) means for varying the spacing between the legs of L-shaped member and adjacent portions of said frames.

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WALTER A. SCHEEL, *Primary Examiner.*

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,397,675 August 20, 1968

John De Ligt

It is certified that error appears in the above identified patent and that said Letters Patent are hereby corrected as shown below:

Column 1, line 42, "In this type of operation it is necessary to maintain a" should read -- sense to cover printing as well as the application of a --. Column 2, line 32, after "frame" insert a semicolon; line 43, after "operation" insert a semicolon; line 67, after "then" insert a comma. Column 3, line 39, after "21" insert a comma; line 55, "wil" should read -- will --. Column 4, line 14, "rearawrdly" should read -- rearwardly --; line 72, "first" should read -- second --.

Signed and sealed this 3rd day of March 1970.

(SEAL)

Attest:

Edward M. Fletcher, Jr.

Attesting Officer

WILLIAM E. SCHUYLER, JR.

Commissioner of Patents

W019050

7

March 18, 1969 R. K. NORTON 3,433,155

MECHANISM FOR APPLYING A COATING TO A PLATE

Filed Sept. 13, 1965 Sheet 1 of 3

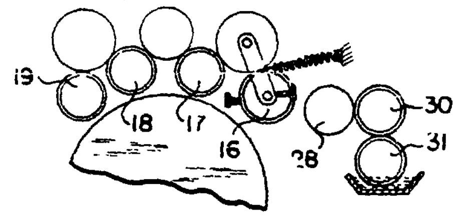

FIG.2

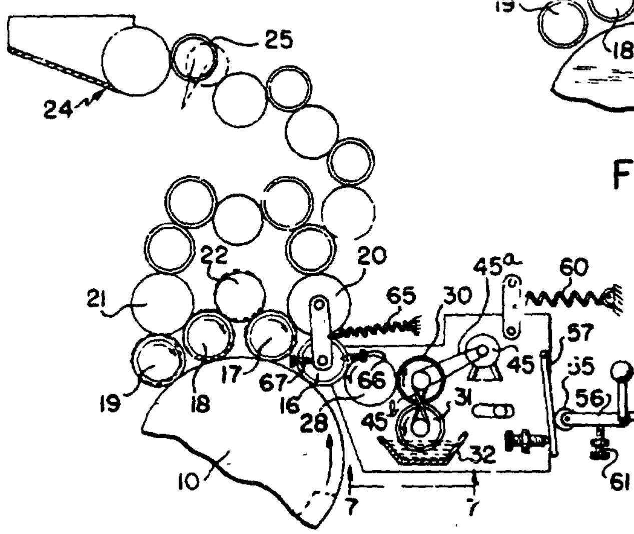

FIG.1

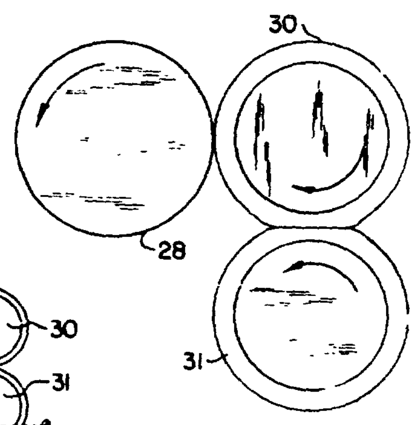

FIG.4

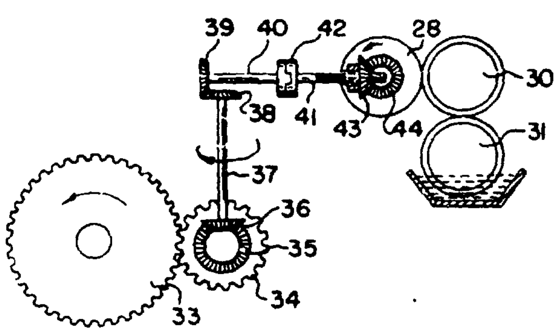

FIG.3

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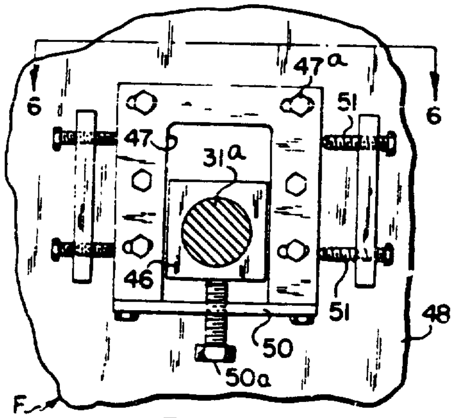

FIG. 5

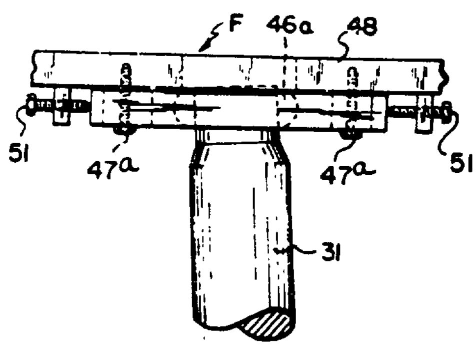

FIG. 6

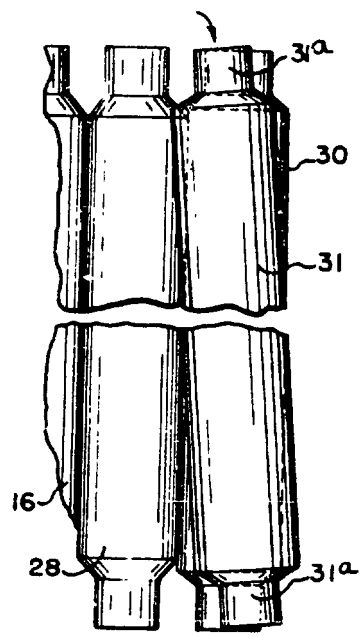

FIG. 7

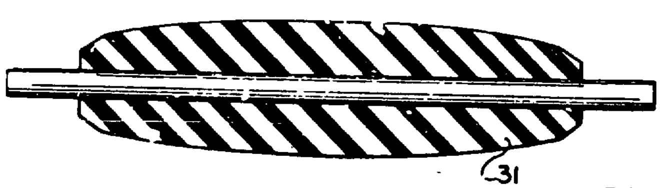

FIG. 8

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W019053

United States Patent Office

3,433,155
Patented Mar. 18, 1969

3,433,155

MECHANISM FOR APPLYING A COATING TO A PLATE

Robert K. Norton, Twinsburg, Ohio, assignor to Harris-Intertype Corporation, Cleveland, Ohio, a corporation of Ohio

Filed Sept. 13, 1965, Ser. No. 486,680
U.S. Cl. 101—148 8 Claims
Int. Cl. B41l 23/04, 25/02; B41f 31/14

ABSTRACT OF THE DISCLOSURE

A dampening mechanism for applying a dampening fluid to the surface of a rotating printing plate of a printing press is disclosed. The dampening mechanism comprises a form roll driven by the printing plate, a hard surface, hydrophilic roll for transferring dampening fluid to the form roll, a resilient metering roll running in pressure engagement with the hydrophilic roll for transferring the dampening fluid to the hydrophilic roll and a resilient pan roll for transferring dampening fluid from a supply to the metering roll. The hard surface, hydrophilic roll is positively rotated to have the same surface speed as the rotating printing plate and the resilient metering roll is driven at a speed which is adjustable to adjust the relative surface speeds between the hard surface, hydrophilic roll and the resilient metering roll to control the amount of dampening fluid delivered to the hydrophilic roll.

The present invention relates to a printing press or other apparatus in which a rotating applicator such as a form roll applies a fluid material, e.g., ink, dampening fluid, or both, to the surface of a printing plate or the like.

An important object of the present invention is to provide a new and improved lithographic printing press having a dampening mechanism in which the flow of dampening fluid is controlled by varying the relative surface speed of cooperating rolls in the dampening mechanism and in which the dampening mechanism includes a positively driven roll which runs in engagement with a form roll, the driven roll being driven at the surface speed of the plate to minimize the effect of scumming on the plate.

Another object of the present invention is to provide a new and improved lithographic printing press wherein the printing plate has dampening fluid applied thereto by a form roll frictionally driven from the plate with dampening fluid being supplied to the form roll from a positively driven hard surface transfer roll whose surface speed is the same as the surface speed of the plate cylinder and in which the dampening fluid on the hard surface transfer roll is controlled by varying the speed of a resilient surface running in pressure engagement with the hard surface transfer roll.

Another object of the present invention is to provide a new and improved lithographic printing press in which dampening fluid being fed to the printing press is first metered by a roll running in pressure relationship with a variable speed roll having a resilient surface with the amount of fluid being transferred by the dampening mechanism being controlled by varying the speed of the variable speed roll to vary the surface speed between the variable speed roll and a positively driven hard surface hydrophilic roll rotating at a predetermined surface speed, preferably at the surface speed of the plate.

Still another object of the present invention is to provide a new and improved lithographic printing press in which a dampening mechanism for feeding dampening fluid to the printing press has the dampening fluid metered and smoothed out by a resilient surface roll which operates as a pan roll and delivers dampening fluid to a cooperating roll having a resilient surface with the surface speed of the cooperating roll and the pan roll being the same but variable to vary the amount of dampening fluid transferred to a hard surface roll running in pressure engagement with the cooperating roll and having a predetermined surface speed.

Yet another object of the persent invention is to provide a new and improved printing press in which a dampening fluid is transferred by a plurality of rolls from a supply therefor to a printing plate and wherein the distribution and amount of dampening fluid is controlled by varying the speed of a roll having a resilient surface to change its surface speed relatively to a hard surface roll with which it has a pressure engagement.

The present invention also contemplates the provision of a new and improved apparatus embodying at least three rolls for feeding fluid material to a rotating applicator in which apparatus a first resilient surface roll controls the transfer of fluid material to a second resilient surface roll which runs in pressure relationship therewith with the surface speed of the resilient surface rolls being the same but variable relative to the speed of a hard surface transfer roll which receives the material from the variable speed transfer roll.

A still further object of the present invention is to provide a new and improved apparatus for applying a coating of fluid material to a moving surface in which a rotating applicator roll for applying the coating is rotated at a surface speed of the moving surface by frictional engagement of the moving surface and by the frictional engagement of roll means running in contact with the periphery of the applicator roll, and in which fluid material is supplied to the applicator roll from a supply therefor by a plurality of rolls including one running at a surface speed different from the surface speed of the moving surface, the plurality of rolls being arranged and driven in a manner such that there is little or no tendency of the applicator roll to slow when not engaged with the moving surface due to the drag of the roll which runs at a different surface speed.

Further objects and advantages of the present invention will be apparent from the following detailed description thereof made with reference to the accompanying drawings forming a part of the present specification and in which:

FIG. 1 is a diagrammatic view showing a portion of a printing press embodying the present invention:

FIG. 2 is a view which corresponds to a portion of FIG. 1 showing certain parts thereof in different positions;

FIG. 3 is a view, somewhat diagrammatic, of a drive for one of the dampening rolls of the apparatus shown in FIG. 1;

FIG. 4 is an enlarged view showing the relationship of three of the dampening rolls of the apparatus shown in FIG. 1;

FIG. 5 is a fragmentary view showing a bearing mounting for one of the rolls of the apparatus shown in FIG. 1;

FIG. 6 is a view taken from approximately line 6—6 of FIG. 5 looking in the direction of the arrows;

FIG. 7 is a view with certain parts omitted looking approximately from line 7—7 of FIG. 1 in the direction of the arrows; and

FIG. 8 is an elevational view of two of the rolls of the apparatus of FIG. 1 with one of the rolls having a modified structure.

The present invention is susceptible for use in various machines where it is desirable to apply a coating of a fluid material onto a moving surface with an applicator roll or other type of rotating applicator but it is particu-

larly useful to apply dampening fluid to the surface of a printing press plate cylinder.

In a lithographic offset printing press, ink and dampening fluid are applied to the printing plate and in the illustrated press, ink is fed to the printing plate through an inking mechanism which includes form rolls 16, 17, 18, 19 which run in engagement with the surface of the printing plate. A vibrating roll 20 is disposed between the form rolls 16, 17 and runs in engagement therewith while a similar vibrator roll 21 engages and runs in contact with form rolls 18, 19. A vibrator roll 22 also engages form rolls 17, 18. The vibrating rolls 20, 21, 22 are conventional vibrator rolls having a hard smooth ink receptive metal surface while the form rolls 16, 17, 18 and 19 have conventional resilient surfaces. The ink is fed to the vibrator rolls 20, 21 from an ink fountain 24 by a duct roll 25 and a plurality of ink transfer rolls shown in the drawing. The train of ink rolls shown for supplying ink to the form rolls is that of a conventional inker and therefore will not be described in detail.

In accordance with the preferred and illustrated embodiment, dampening fluid is applied to the plate on the cylinder 10 by a dampening mechanism which feeds the dampening fluid through the first form roll 16 which is larger than the other form rolls. The dampening mechanism includes roll 28 having a hard hydrophilic, smoothly finished surface, preferably chrome, which rotates in pressure relationship with the first form roll 16, a resilient surface variable speed roll 30 which runs in pressure relationship with the hard chrome roller 28 and a cooperating metering roll 31 having a resilient surface and rotating in a pan 32 containing the dampening fluid. The metering pan roll 31 picks up dampening fluid from the pan 32, transfers it to the roll 30, which in turn transfers the dampening fluid to the chrome transfer roll 28 running in engagement with the first form roll 16 to feed the dampening fluid to the form roll and from the form roll 16 to the plate. To control the amount of dampening fluid being transferred between the pan 32 and the form roll, the roll 30 is driven at a speed which is variable to vary the relative surface speeds of the metering roll 30 and the chrome transfer roll 28. The variable speed metering roll 30 and the metering pan roll 31 are driven to rotate at the same surface speed. Consequently, the metering pan roll 31 is rotated at the same surface as the metering roll 30 but this surface speed is variable to control the amount of fluid transferred between the roll 30 and the roll 28 which rotates at a fixed surface speed for a given press speed. The rolls 28, 30 and 31 each preferably rotate in an opposite direction to the roll or rolls which it engages, but the rolls 30, 31 may be driven so that the roll 30 rotates in the same direction as the chrome roll 28.

In the preferred mechanism the chrome transfer roll 28 is positively driven from the plate cylinder and is rotated at the same surface speed as the plate cylinder. The vibrator roll 20 is also positively driven from the press at the same surface speed as the plate cylinder in a conventional manner and the form roll 16 is frictionally driven from the vibrator roll 20, the chrome transfer roll 28 and the plate cylinder. In the illustrated arrangement, the chrome transfer roll 28 is shown as being driven from a gear 33 which is on the plate cylinder and rotates therewith. The gear 33 drives a gear 34 which drives a shaft 37 through bevel gears 35, 36. The shaft 37 is connected by bevel gears 38, 39 to drive a shaft 40 which in turn drives a shaft 41 through a clutch 42. The shaft 41 has a bevel gear 43 thereon which meshes with a bevel gear 44 on the shaft of the transfer roll 28 The spline connection of the gear 43 allows the transfer roll 28 to be moved into and out of engagement with the form roll 16 while maintaining a drive thereto. The chrome roll is preferably driven at the surface speed of the plate cylinder to frictionally drive the form roll 16 at this speed to thereby prevent any drag on the form roll which may occur when a roll which runs in engagement therewith rotates at a slower surface speed. In mechanisms where the dampening roll running in engagement with the form roll is driven at a slower speed, there is a frictional drag on the form roll which tends to slow the form roll as the gap which is present in conventional plate cylinders passes the form roll. I have found that this may cause a scumming or smudging on the lead edge portion of the printing plate. By providing a dampening mechanism where the roll of the dampening mechanism in engagement with the form roll is positively driven at the surface speed of the plate cylinder, this tendency of the slower speed roll 30 to effectively brake the form roll is overcome or minimized.

The variable speed metering roll 30 is driven by a variable speed motor 45 through a positive drive shown as a chain drive 45a. A chain drive 45b may also be used to drive the metering roll 31 from the roll 30 to rotate them in a 1 to 1 relationship so that they have the same surface speeds.

In the described mechanism, the chrome transfer roll 28 and the form roll 16 are of the same length but the metering roll 30 is longer than the chrome transfer roll 28 so as to extend beyond the opposite ends thereof.

The pressure relationship between the metering pan roll 31 and the metering roll 30 is adjustable to smoothly meter the flow of dampening fluid between the nip of the rolls to provide an evenly distributed thin film of dampening fluid on the roll 30. The pan metering roll 31 preferably has shaft portions extending from the opposite ends thereof to be supported in bearing blocks which may be moved toward and away from the metering roll 30 to adjust the pressure relationship between the rolls 30, 31. Bearing blocks of this type are conventional and well known in the art and a simplified bearing support for the roll 31 is shown in FIG. 5. As shown in FIG. 5, the shaft portion 31a extending from one end of the roll 31 is received in a self-centering bearing 46a in a bearing block 46 which is supported in an inverted U-shaped recess in a guide block 47 mounted on a support member 48 of the frame F of the press. The open end of the U-shaped recess is closed by a plate 50 and a pressure adjusting bolt 50a is threaded through the plate 50 to engage the bearing block 46 and is adjustable to move the roll 31 upwardly into an adjustable pressure relationship with the roll 30. Preferably, the mounting block 47 is mounted onto the support member 48 by screws 47a which are received in elongated slots in the mounting block to allow the mounting block 47 and the bearing block 48 to be shifted laterally, i.e. horizontally, to adjust the axis of the roll 31 to provide a skewed relationship relative to the roll 30. The mounting block 47 is shown as being adjustable laterally by the operation of a plurality of adjusting screws 51. Since the metering pan roll 31 is supported at both ends by the same type of support the metering roll 31 can be moved to a skewed position relative to the roll 30 as is best shown in FIG. 7. The bearings 46a at each end of the roll 31 pivot in the respective block 46 to accommodate the skewing of the roll.

A skewed position for the metering roll 31 is advantageous to obtain a thin evenly distributed film on the roll 31. When a pressure relationship is established by applying forces to the shaft portions at the opposite ends of the metering roll 31, the roll tends to bow outwardly in the center portion of the roll and to allow more dampening fluid to pass the center portion of the roll than the ends of the roll. By skewing the axis of the rolls 30, 31, an even pressure relationship along the area of contact can be obtained since bowing the roll is required to provide an even contact when the rolls are skewed

The roll 31 may be a crowned roller as indicated in FIG. 8. In FIG. 8, the roll 31 tapers in an arcuate manner from the central portion thereof to the ends so that when the pressure relationship is established between the rolls 30, 31, the rolls engage over an area of substantially constant width. Preferably, the area of contact is a narrow strip extending the length of the rolls 30, 31.

The exact extent of the crown may be determined empirically and varies in accordance with the length of the roll and its strength and in accordance with the materials involved. A crowned roll may be used in combination with skewing or in lieu of skewing.

The resilient roll **30** and the chrome roll **28** also run in pressure relationship and this relationship may be adjustable by the use of movable bearing blocks similar to those on the roll **31**.

As indicated by dotted lines in FIG. 1, the form rolls **17**, **18** and **19** are supported for movement to an inker off position in a conventional manner while the form roll **16** is moved from its position against the plate by operation of the dampening mechanism. The dampening mechanism as a whole is supported for movement toward and away from the cylinder to move the chome roll **28** into and out of engagement with the form roll **16**. A roller **55** on a pivoted actuating arm **56** may be swung to the position shown in FIG. 1 to move the dampening mechanism from the position shown in FIG. 2 to establish the pressure relationship between the relative positions of the chrome roll **28** and the form roll **16** shown in FIG. 1. The roller engages an adjustable plate **57** on the dampening mechanism to move the latter against the action of a spring **60**. Stops **61**, **62** may be provided to limit the movement of the arm between the inker on and inker off position. In its "on" position, the pivoted arm **56** is in a dead center or locking position slightly over dead center. Adjustment of the plate **57** determines the "on" position of the dampener and the pressure relationship between the rolls **16**, **28**.

When the vibrating roll **28** is to be moved out of engagement with the form roll **16**, the arm **56** is rotated to allow the dampening mechanism to be moved away from the impression cylinder by the spring **60**.

In the illustrated embodiment, the form roll **16** is mounted for limited movement about the axis of the vibrator roll **20**. When the dampening mechanism is moved to clear the chrome roll **28** from the form roll **16**, the form roll is moved by a spring **65** against a stop **66** to move the form roll out of engagement with the plate cylinder. When the dampening mechanism is again moved to its operative position, the chrome roll **28** engages the form roll **16** and moves it against the spring **65** to a position against the plate cylinder and against a stop **67** which limits the pressure that the form roll may apply to the plate cylinder and provides a resisting force to the chrome roll **28** to establish a pressure relationship between the chorme roll **28** and the form roll **16**.

It can be seen that with the described construction, the dampening mechanism can be operated when the mechanism is in its retracted position to form films on the rolls of the dampening mechanism and to cause the chrome roll **28** to be operating at press speed when it is moved into engagement with the form roll. It will be noted that the dampening mechanism can be moved to engage the form roll **16** with the chrome roll **28** rotating at the surface speed of the press, prior to the form roll engaging the plate. This enables the form roll **16** and the chrome roll **28** to be rotating at their proper speeds when the form roll **16** engages the plate. By positively driving the chrome roll **28**, the chrome roll **28** will be driven at its proper speed when it is moved into engagement with the form roll **16** and the form roll **16** will be driven from both the vibrating roll **20** and the chrome roll **28**. This will also keep the form roll **16** rotating at a surface speed corresponding to the surface speed of the plate cylinder **10** when the gaps in the cylinder **10** are moving past the form roll **16**.

It will be understood by those skilled in the art that the term hard surface roll as used in this specification includes a roll having an unyielding surface such as is commonly present on vibrator rolls and chrome hydrophilic rolls and is used to distinguish from other rolls commonly used in presses and which have a yieldable, resilient surface such as neoprene or rubber.

While the preferred embodiment and other embodiments of the present invention have been disclosed and described in detail, it is hereby my intention to cover all modifications, adaptations and arrangement of parts which fall within the ability of those skilled in the art and within the spirit of the appended claims.

Having described my invention, I claim:

1. In a lithographic printing press having a printing plate mounted on a rotatable plate cylinder with a gap therein, a dampening mechanism for supplying dampening fluid to an applicator roll running in engagement with a printing plate on the plate cylinder, a supply comprising a reservoir of dampening fluid for said plate, a hydrophilic roll running in rolling contact with said applicator roll, first drive means independent of the surface of said hydrophilic roll for positively driving said hydrophilic roll at the surface speed of said printing plate, means for delivering dampening fluid to said hydrophilic roll and forming an even film thereon comprising a resilient surface roll, first support means supporting said resilient surface roll to roll in engagement with said hydrophilic roll and for adjustment toward and away from said hydrophilic roll, second drive means apart from the surface of said resilient surface roll for driving said resilient surface roll at a surface speed which is adjustable independently of adjusting the speed of said hydrophilic roll to adjust the relative surface speeds of said resilient surface roll and said hydrophilic roll to control the amount of dampening fluid delivered to said hydrophilic roll, and means for delivering dampening fluid to said resilient surface roll and for metering the fluid delivered to form a thin evenly distributed film on said resilient surface roll comprising a pan roll which dips into said reservoir of dampening fluid, and second support means rotatably supporting said pan roll in continuous engagement with said resilient surface roll including means for adjusting the axis of said pan roll toward and away from said resilient surface roll separately from the adjustment of said resilient roll toward and away from said hydrophilic roll.

2. In a lithographic printing press having a printing plate mounted on a rotatable plate cylinder with a gap therein, a dampening mechanism for supplying dampening fluid to an applicator roll in running engagement with the printing plate on the rotating plate cylinder, a supply of dampening fluid, a hydrophilic roll running in rolling contact with said applicator roll, said hydrophilic roll having a hard unyieldable hydrophilic surface, drive means independent of the surface of said hydrophilic roll for positively driving said hydrophilic roll at the surface speed of said printing plate, means for delivering dampening fluid to said hydrophilic roll and forming an even film thereon comprising a resilient surface roll, means supporting said resilient surface roll to run in engagement with said hydrophilic roll with the axes of said hydrophilic roll and said resilient surface roll being spaced generally horizontally from each other, said means supporting said resilient surface roll comprising adjustable means for adjusting the distance between the axes of said hydrophilic roll and said resilient surface roll to adjust the pressure relationship therebetween, a metering pan roll disposed generally vertically below said resilient surface roll, means supporting said pan roll for rotation and running engagement with said resilient surface roll including means for adjusting the axis of said pan roll vertically to adjust the pressure relationship between said pan roll and said resilient surface roll, a pan providing a reservoir of fluid in which the lower portion of said pan roll runs, and means for driving said pan roll and said resilient surface roll at the same speed which is slower than the surface speed of the plate cylinder.

3. In a lithographic printing press, a dampening mechanism as defined in claim 2 wherein said supporting means for said pan roll comprises adjustable bearing supports

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for adjusting the axis of said support roll horizontally to skew the roll with respect to the resilient surface roll and vertically to urge the skewed pan roll into uniform pressure engagement with said resilient surface roll for substantially the entire length of the rolls.

4. In a lithographic printing press as defined in claim 2 wherein said pan roll comprises a roll having a diameter which progressively decreases proceeding from the center toward each end to compensate for deflection of said shaft means on the establishment of a pressure relationship between pan roll and said resilient surface roll.

5. In a lithographic printing press, a dampening system for supplying fluid to a form roll running in engagement with the plate cylinder comprising a pan containing a reservoir of dampening fluid, a pan roll having its lower portion running in the reservoir of dampening fluid, a resilient surface roll disposed above the pan roll and running in engagement therewith, said pan roll having shaft means projecting outwardly from each end thereof, bearing means supporting said shaft means including means for adjusting said shaft means horizontally to skew said pan roll relative to said resilient surface roll and means for adjusting said shaft means vertically to adjust the pressure relationship between said resilient surface roll and said pan roll, and a third roll running in liquid transfer relationship with said resilient surface roll with the axis of said third roll being disposed generally horizontally from the axis of said resilient surface roll, drive means separate from the surface of said third roll for driving said third roll at a fixed speed, motor means connected to one of said pan and resilient rolls separately from the surface thereof to drive said pan and resilient surface rolls at the same surface speed and at a speed slower than the speed of said third roll.

6. In a lithographic printing press as defined in claim 5 wherein the press includes means supporting said rolls to move said third roll into and out of engagement with said form roll while running in engagement with each other, said drive means for driving said third roll and said motor means being operable to drive the corresponding rolls when said third roll is clear of said form roll and when in engagement with the latter.

7. In a lithographic printing press, a dampening system for supplying fluid to form a roll running in engagement with the plate cylinder comprising a pan containing a reservoir of dampening fluid, a pan roll having its lower portion running in the reservoir of dampening fluid, a resilient surface roll disposed above the pan roll and running in engagement therewith, said pan roll having shaft means projecting outwardly from each end thereof, bearing means supporting said shaft means including means for adjusting said shaft means vertically to adjust the pressure relationship between said resilient surface roll and said pan roll, and a third roll running in liquid transfer relationship with said resilient surface roll with the axis of said third roll being disposed generally horizontally from the axis of said resilient surface roll, drive means separate from the surface of said third roll for driving said third roll at a fixed speed, motor means connected to one of said pan and resilient rolls separately from the surface thereof to drive said pan and resilient surface rolls at the same surface speed and at a speed slower than the speed of said third roll, said pan roll comprising a roll having a diameter which progressively decreases proceeding from the center toward each end to compensate for deflection of said shaft means on the establishment of a pressure relationship between pan roll and said resilient surface roll.

8. In a lithographic printing press, a dampening system for supplying fluid to a form roll running in engagement with the plate cylinder comprising a pan containing a reservoir of dampening fluid, a pan roll having its lower portion running in the reservoir of dampening fluid, a resilient surface roll disposed above the pan roll and running in engagement therewith, said pan roll having shaft means projecting outwardly from each end thereof, bearing means supporting said shaft means including means for adjusting said shaft means horizontally to skew said pan roll relative to said resilient surface roll and means for adjusting said shaft means vertically to adjust the pressure relationship between said resilient surface roll and said pan roll, and motor means connected to one of said pan and resilient rolls separately from the surface thereof to drive said pan and resilient surface rolls at the same surface speed and at a speed slower than the surface speed of said form roll.

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EDGAR S. BURR, *Primary Examiner.*

U.S. Cl. X.R.

101—349; 118—262, 222—30; 235—94; 346—98

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United States Patent

[11] **3,536,006**

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[21] Appl. No. **652,452**
[22] Filed **July 11, 1967**
[45] Patented **Oct. 27, 1970**
[73] Assignee **Vandercook & Sons, Inc.**
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[54] **MULTICOLOR ROTARY OFFSET PRINTING PRESS WITH CYLINDER INTERRUPTION**
22 Claims, 36 Drawing Figs.

[52] **U.S. Cl.** **101/137,** 101/148, 101/209, 101/247, 101/415.1
[51] **Int. Cl.** **B41f 7/06,** B41f 13/48, B41f 31/18
[50] **Field of Search** .... 101/174, 175, 177, 182, 183, 184, 185, 137, 139, 140, 217, 218, 247, 148, 352, 351, 206—209, 415.1

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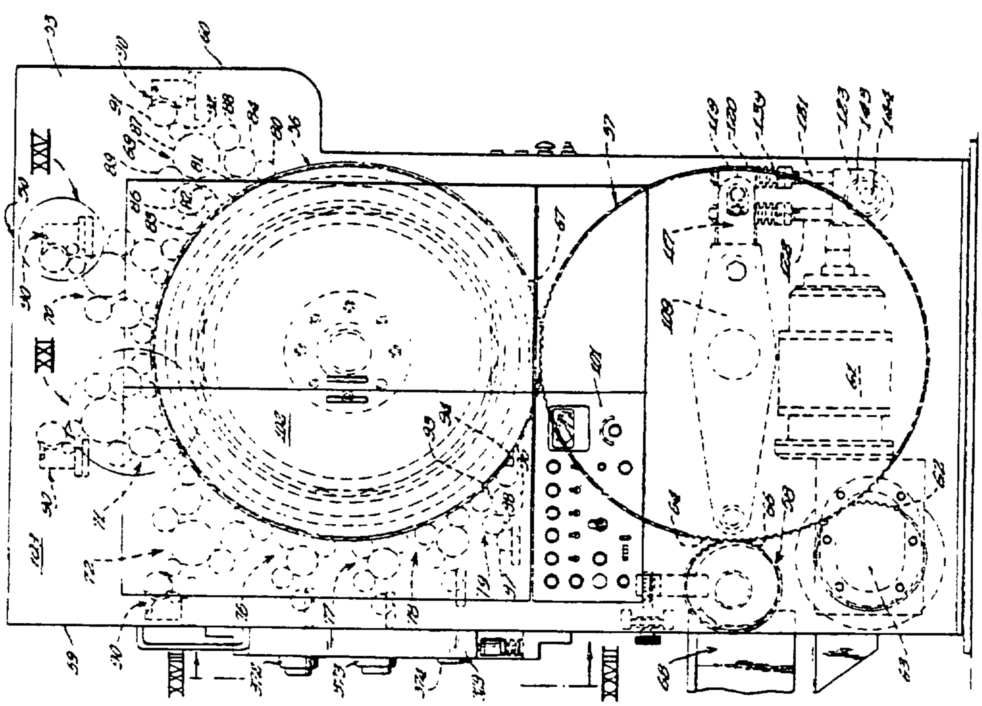
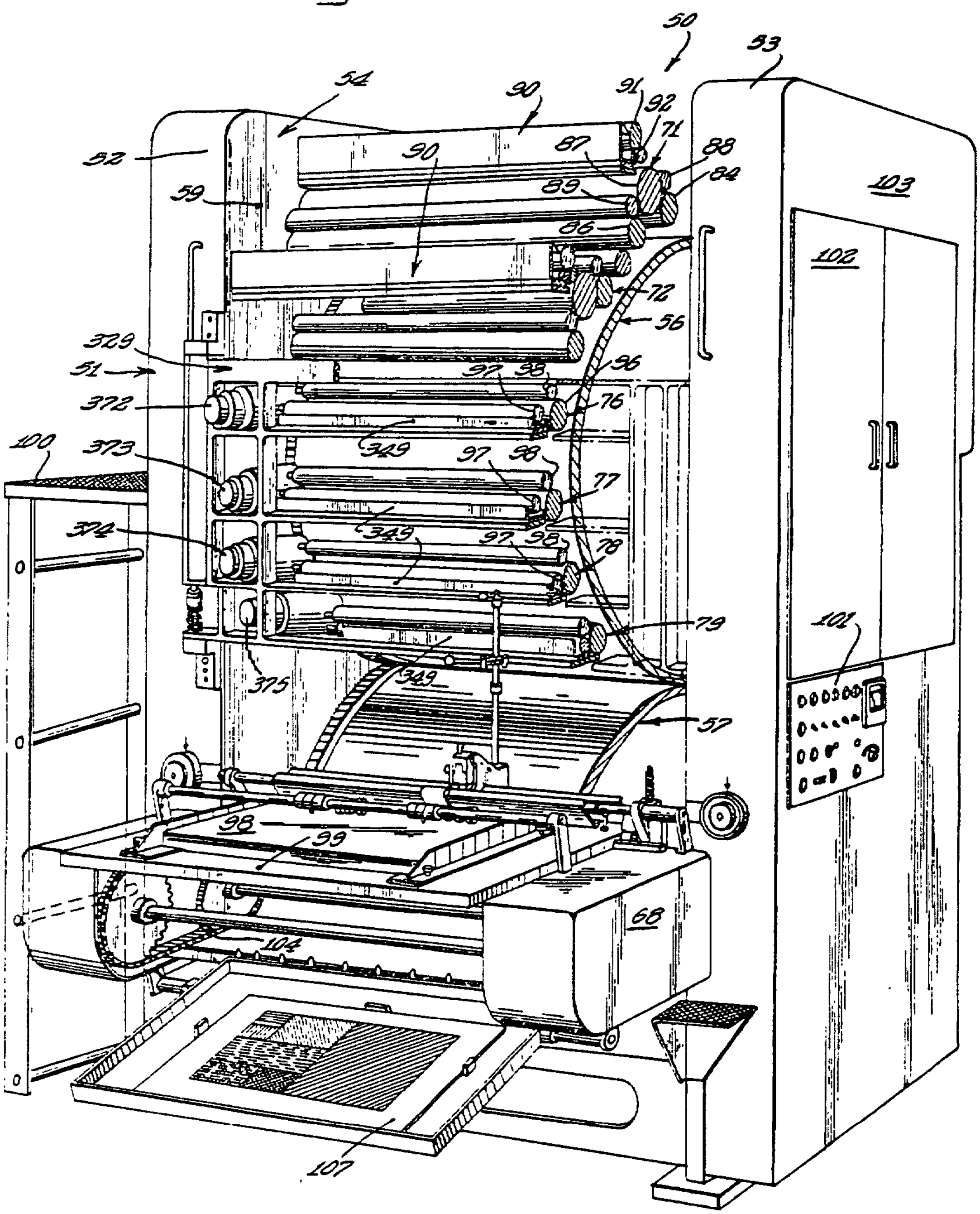
ABSTRACT: A multi color offset printing press of the rotary type in which a single circumferentially color-segmented plate cylinder is disposed above a single circumferentially segmented blanket cylinder, and the impression cylinder is disposed to one side of the blanket cylinder. A series of circumferentially extending cams is formed on the plate cylinder to successively move corresponding series of cam follower-driven inking and dampener rolls into and out of engagement with corresponding color segments of the plate cylinder as the plate cylinder rotates. A second series of cams is mounted on the sides of the blanket cylinder. This second series cooperates with cam followers connected to the journal members of the blanket and impression cylinders for tripping the blanket cylinder alternately to a print position, at which it engages the plate cylinder, and to a trip position, at which it is out of engagement with the plate cylinder, and for tripping the impression cylinder alternately to a print position, at which it engages the blanket cylinder, and to a trip position, at which it is out of printing engagement with the blanket cylinder, as the blanket cylinder is rotated at normal operational speeds. Electric solenoids are provided for selectively maintaining the respective cylinders in the printing positions thereof with respect to one or more of the corresponding color segments of the plate and blanket cylinders

The plate cylinder is driven by a variable speed motor. The rolls of the dampener systems which engage and apply the water to the plate cylinder are driven at a speed proportionate to the speed of the plate cylinder. The fountain rolls of the dampener systems are mounted on a door member which is pivotally mounted on the frame of the press and are individually driven by variable speed motors. Speed controls operatively interconnect the plate cylinder motor and the fountain roll motors to vary the ratio of plate cylinder speed to fountain roll speed as a function of variations in plate cylinder speed.



Patented Oct. 27, 1970 **3,536,006**

Fig. 1



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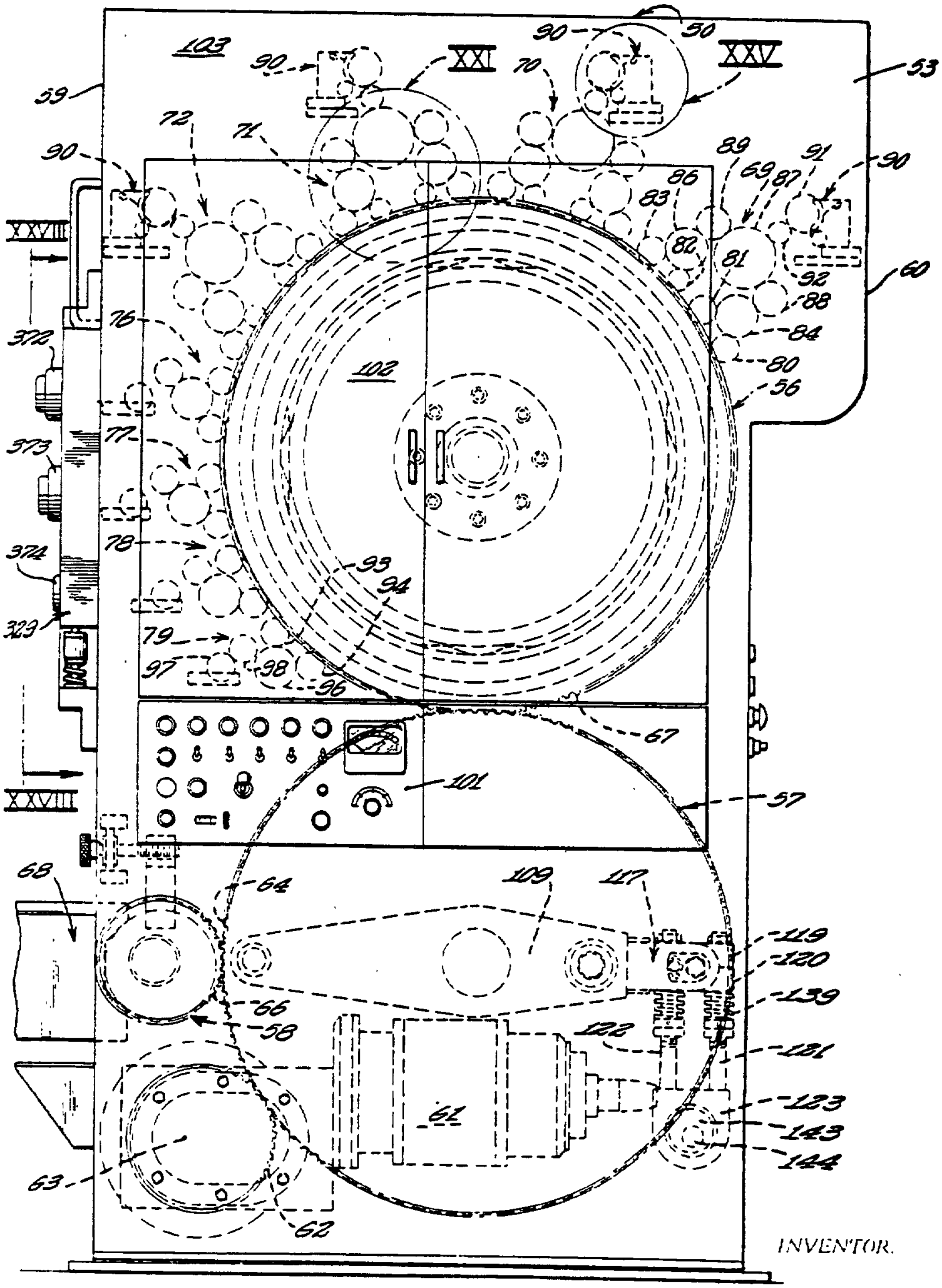

Fig.2

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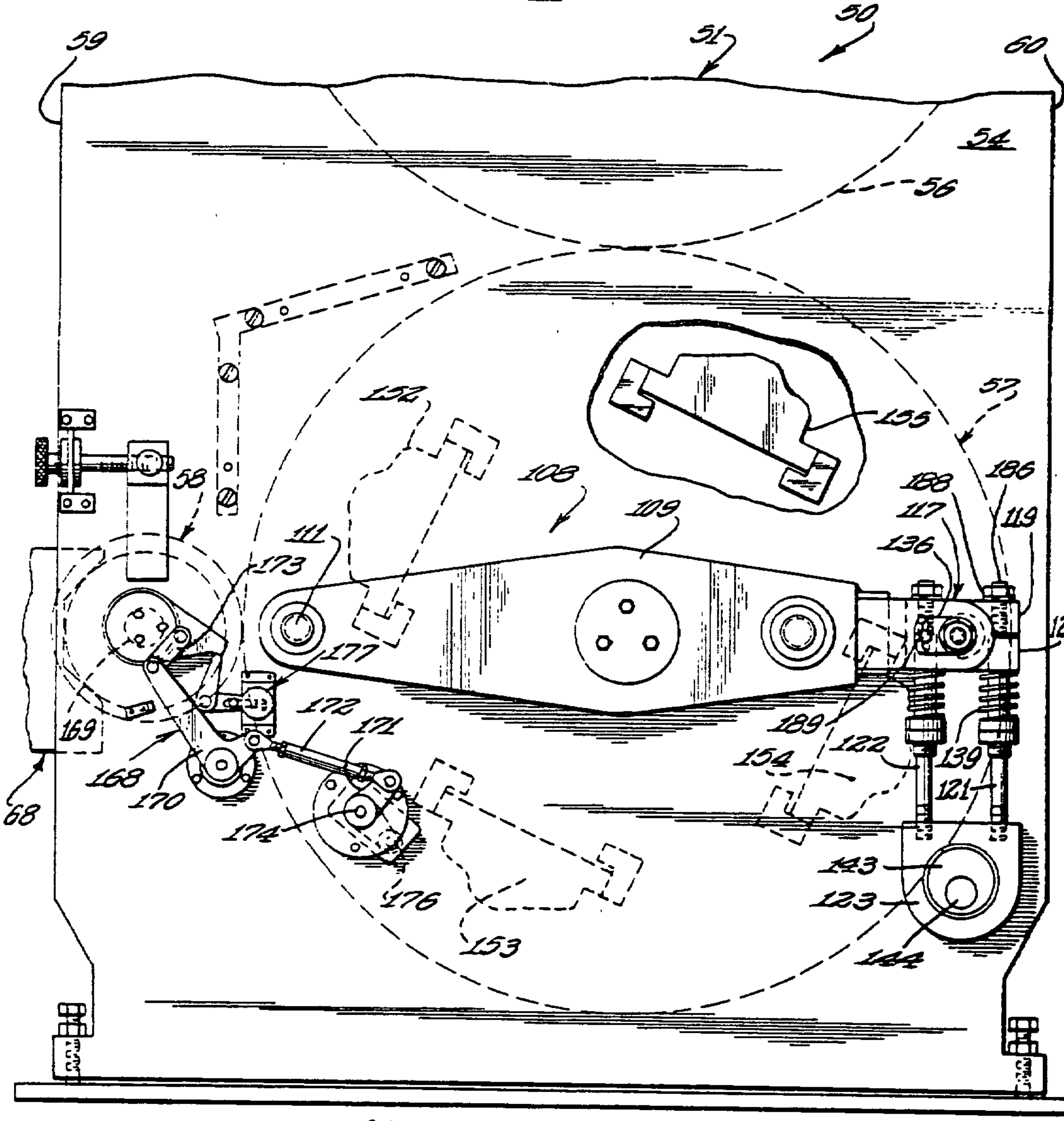
Patented Oct. 27, 1970 **3,536,006**

Fig. 3



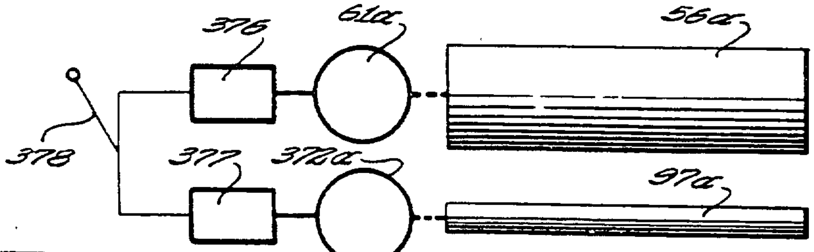


Fig. 36

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Fig. 5

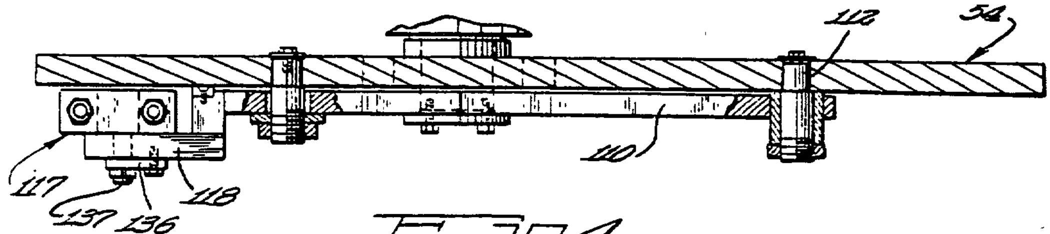
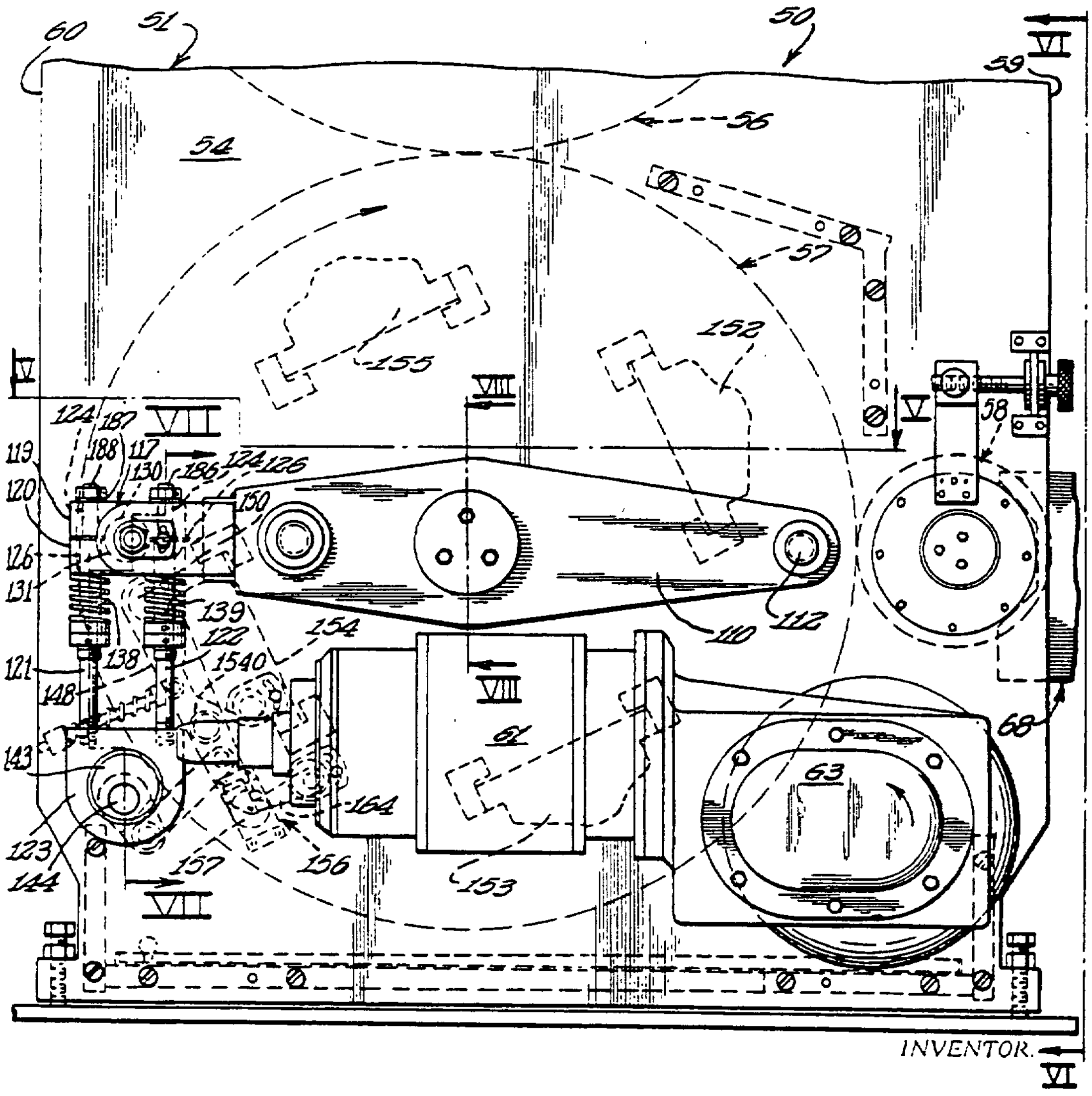


Fig. 4



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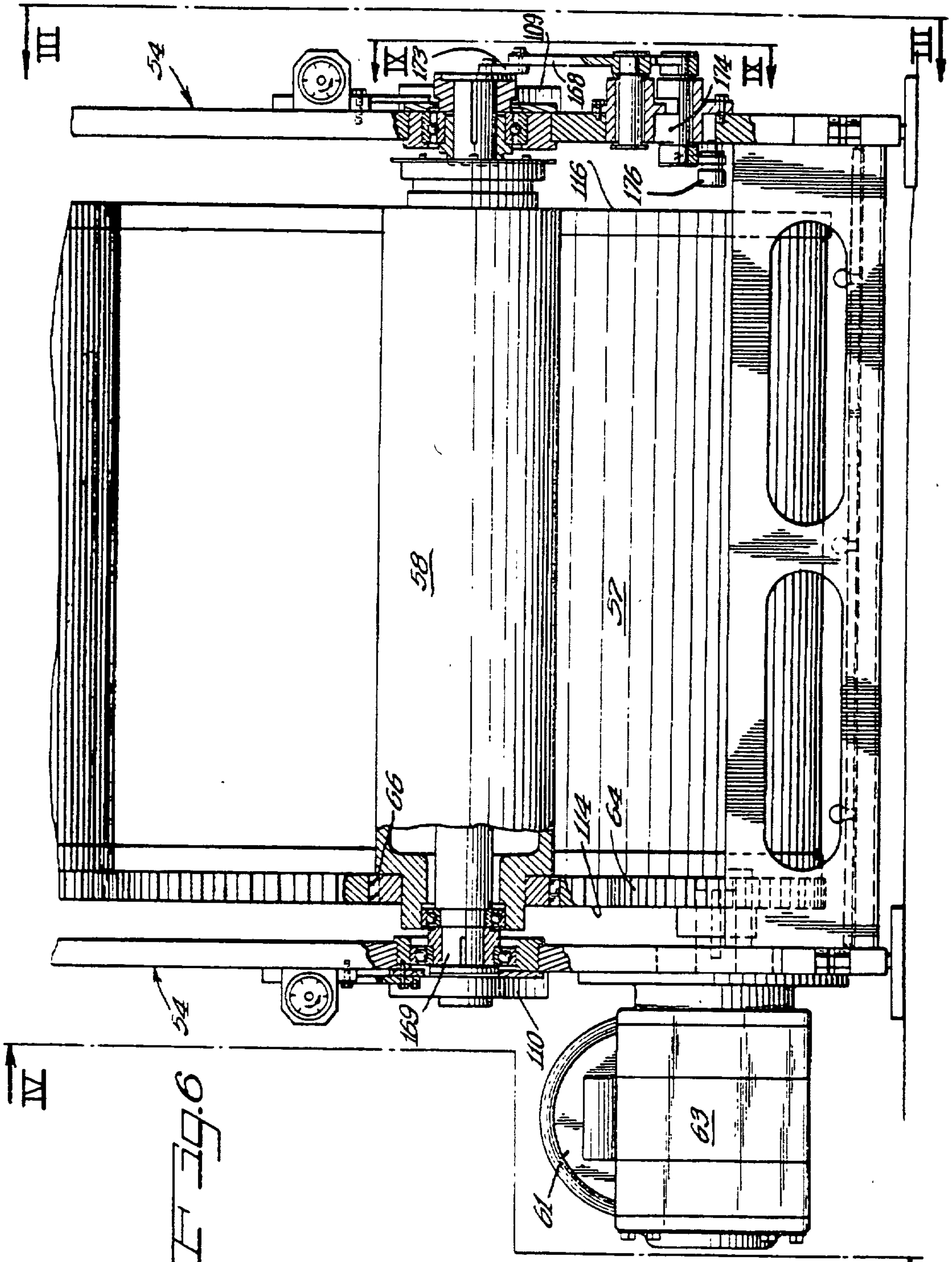

Fig. 6

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Fig. 24

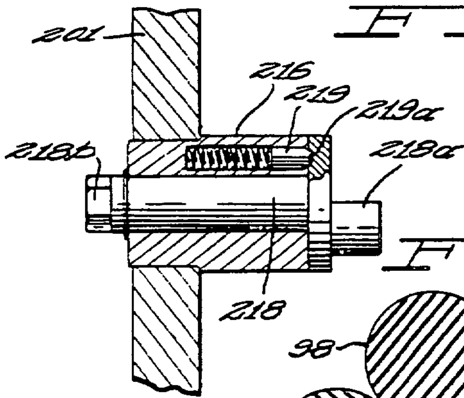


Fig. 7

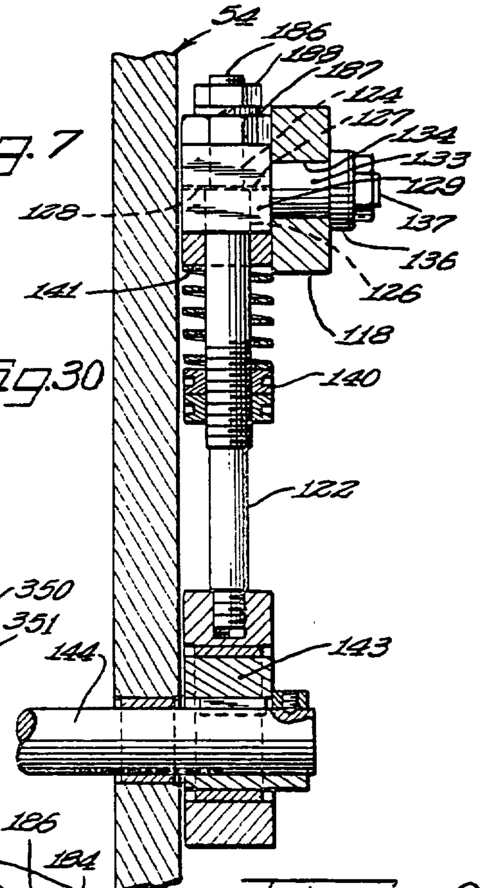
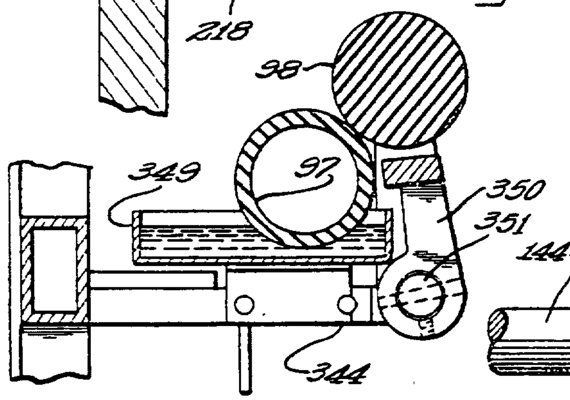


Fig. 30



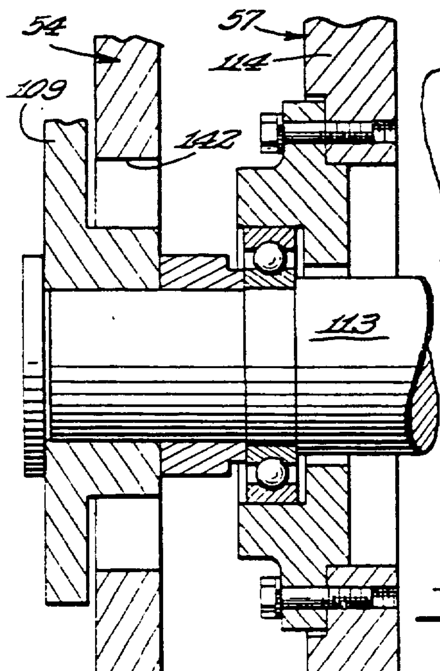
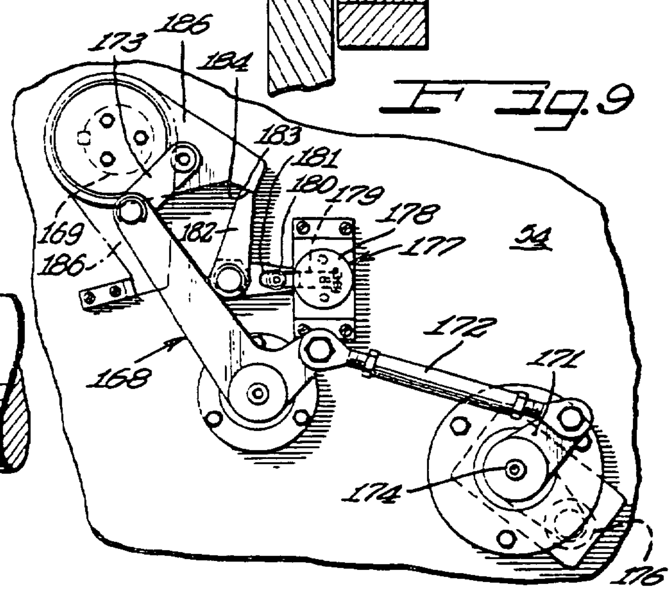


Fig. 8

Fig. 9



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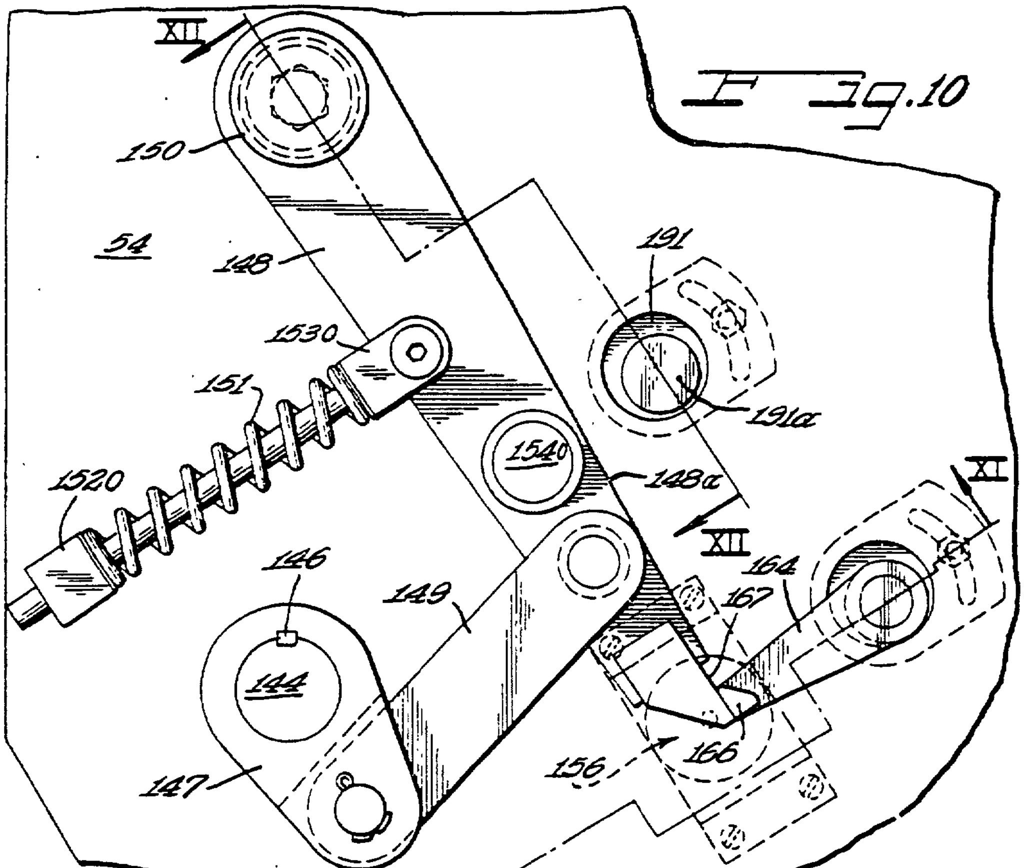

Fig.10

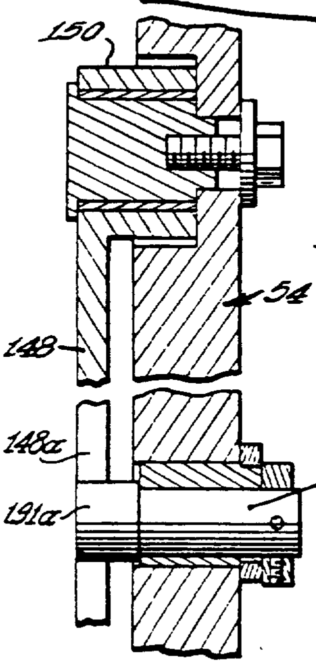

Fig.12

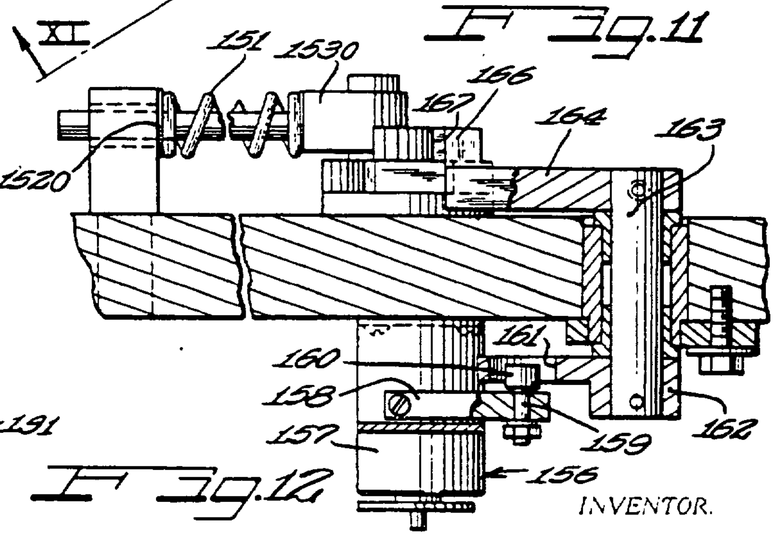

Fig.11

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Fig. 13

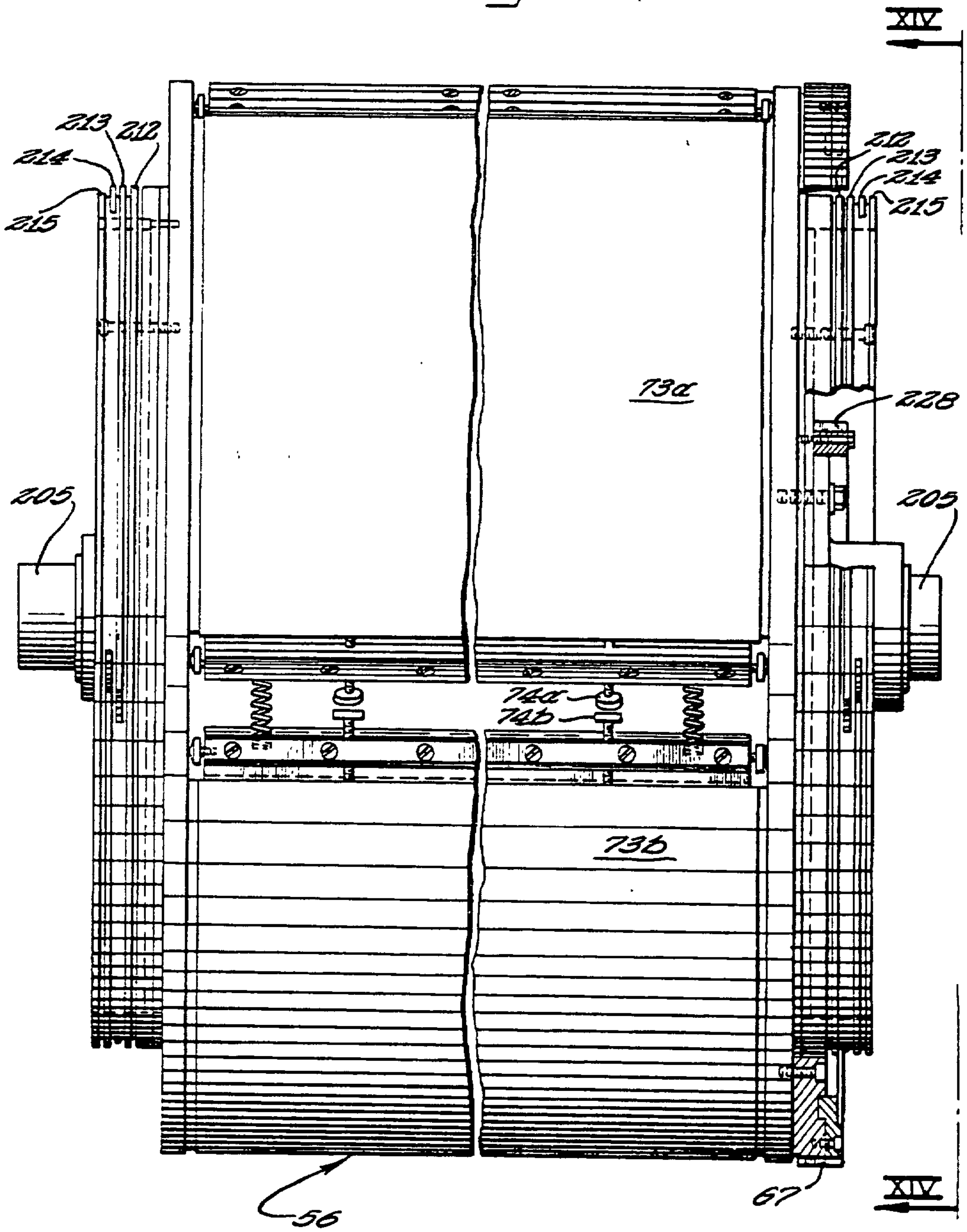

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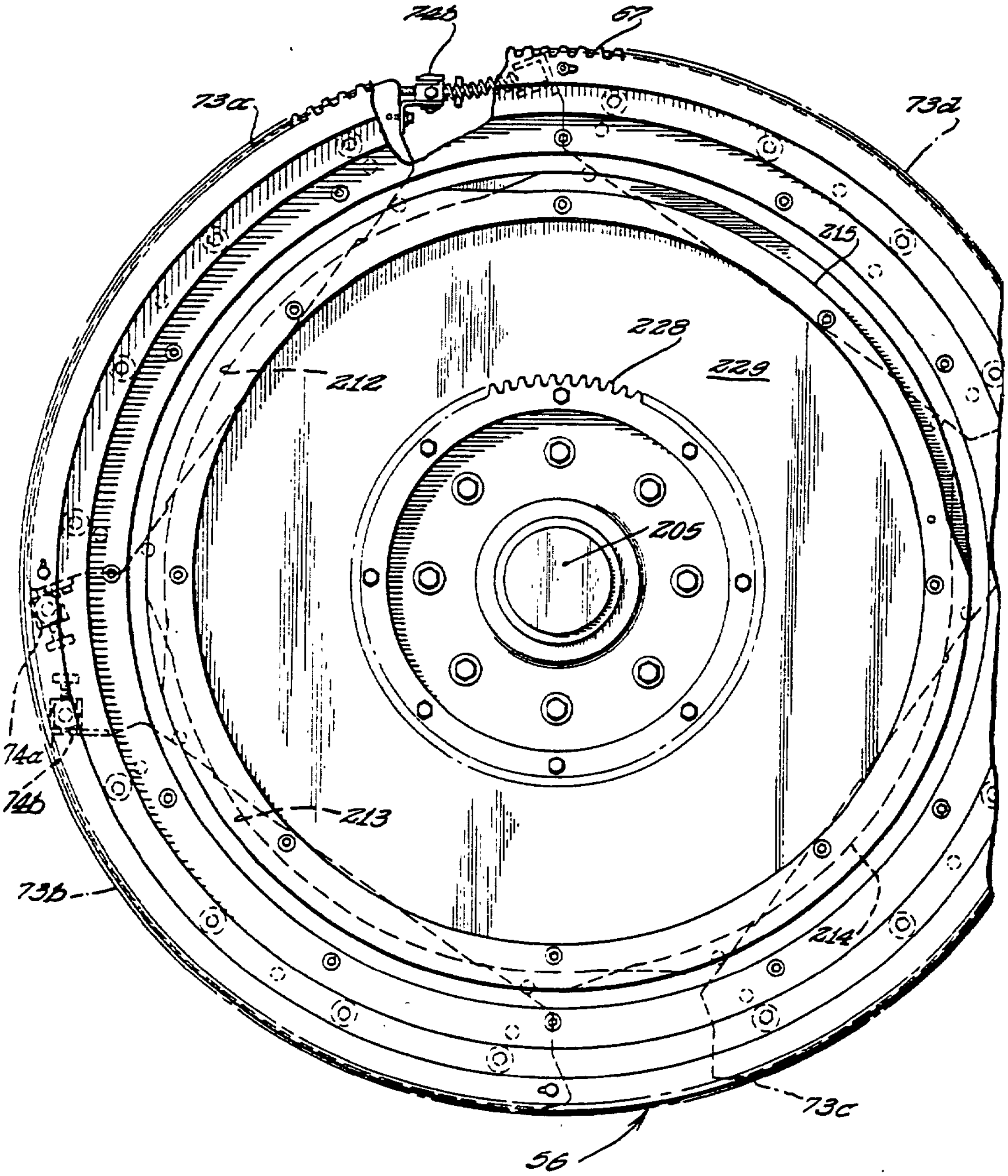
Fig. 14



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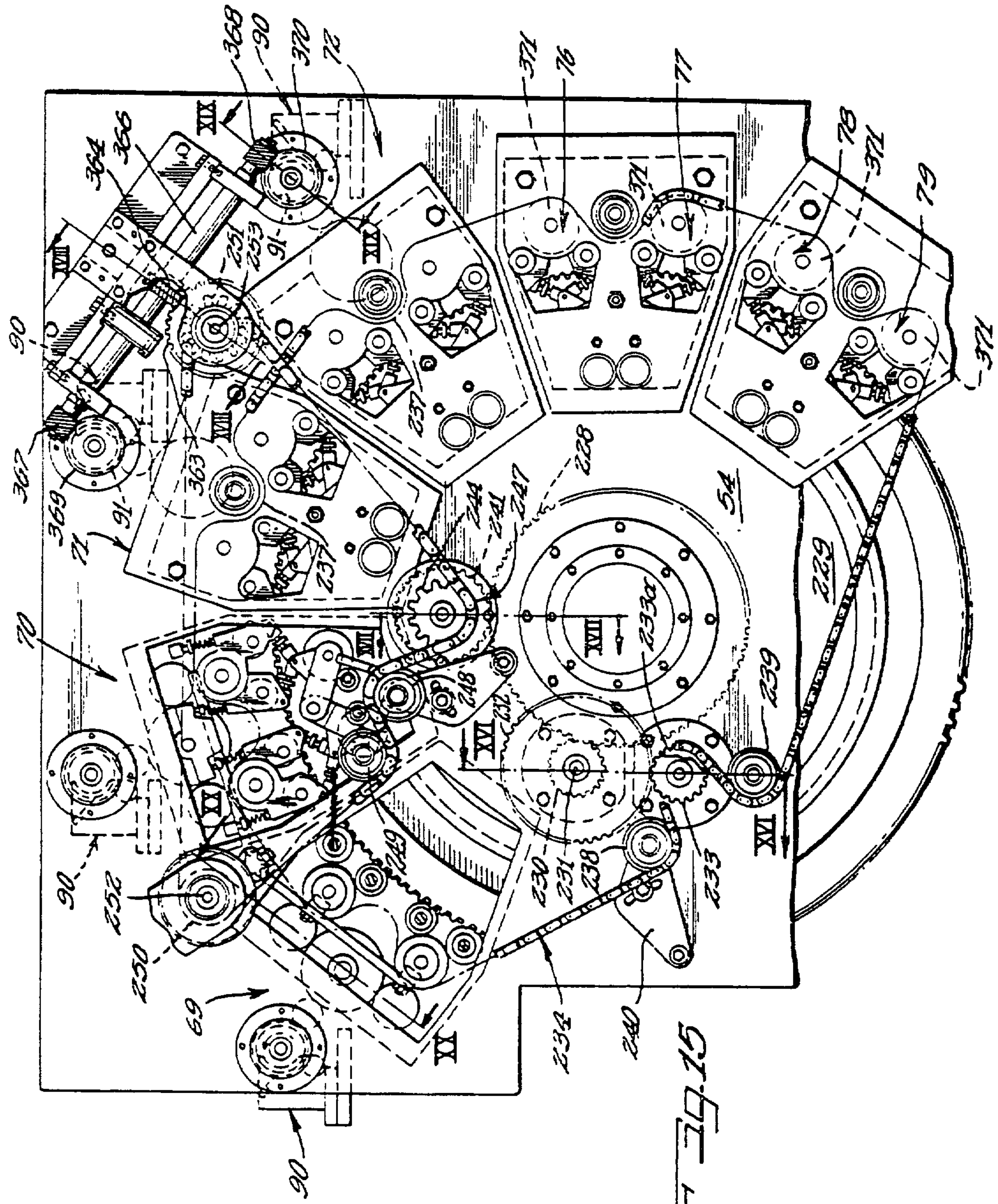

Fig. 15

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Fig.16

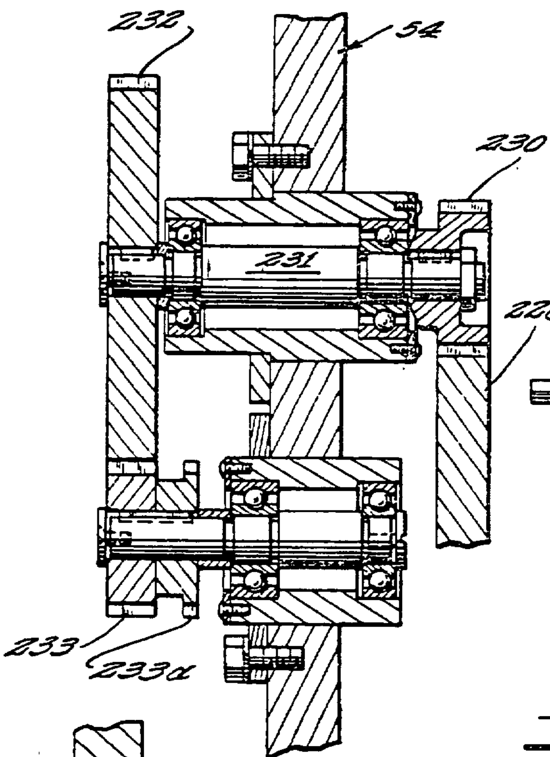


Fig.23

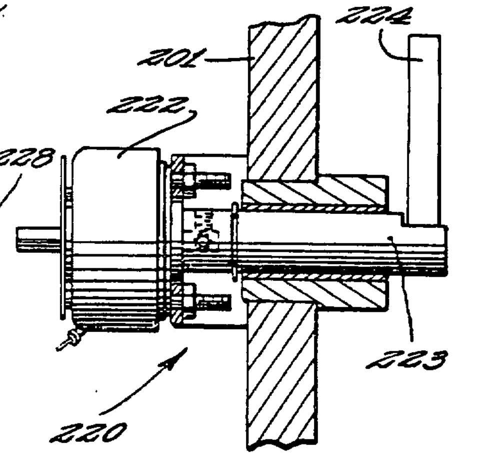
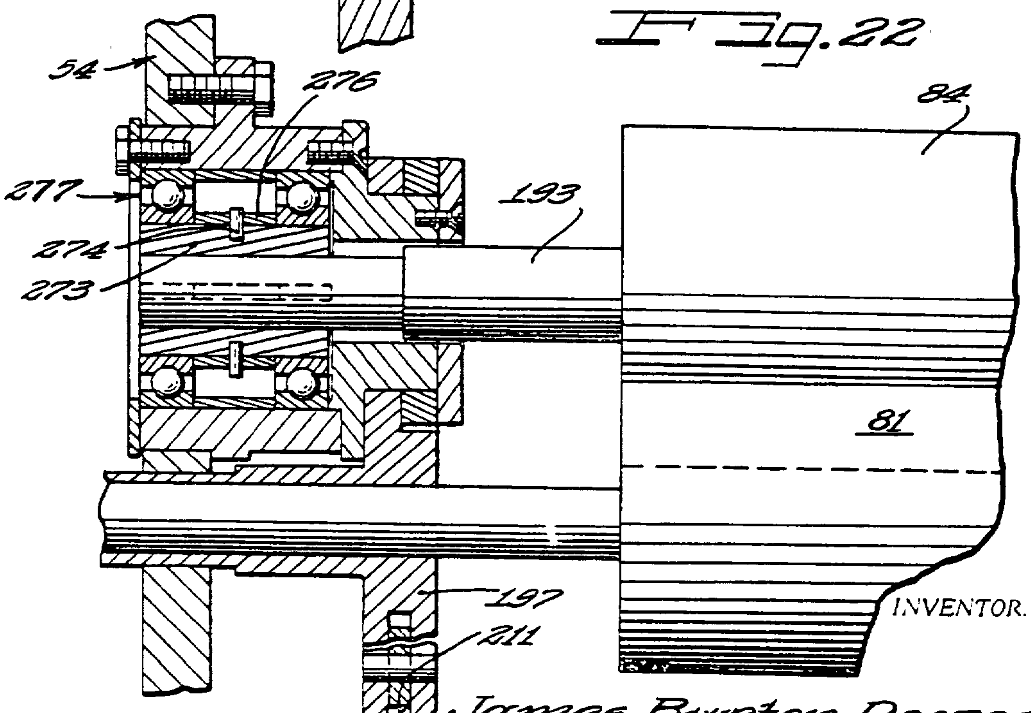


Fig.22



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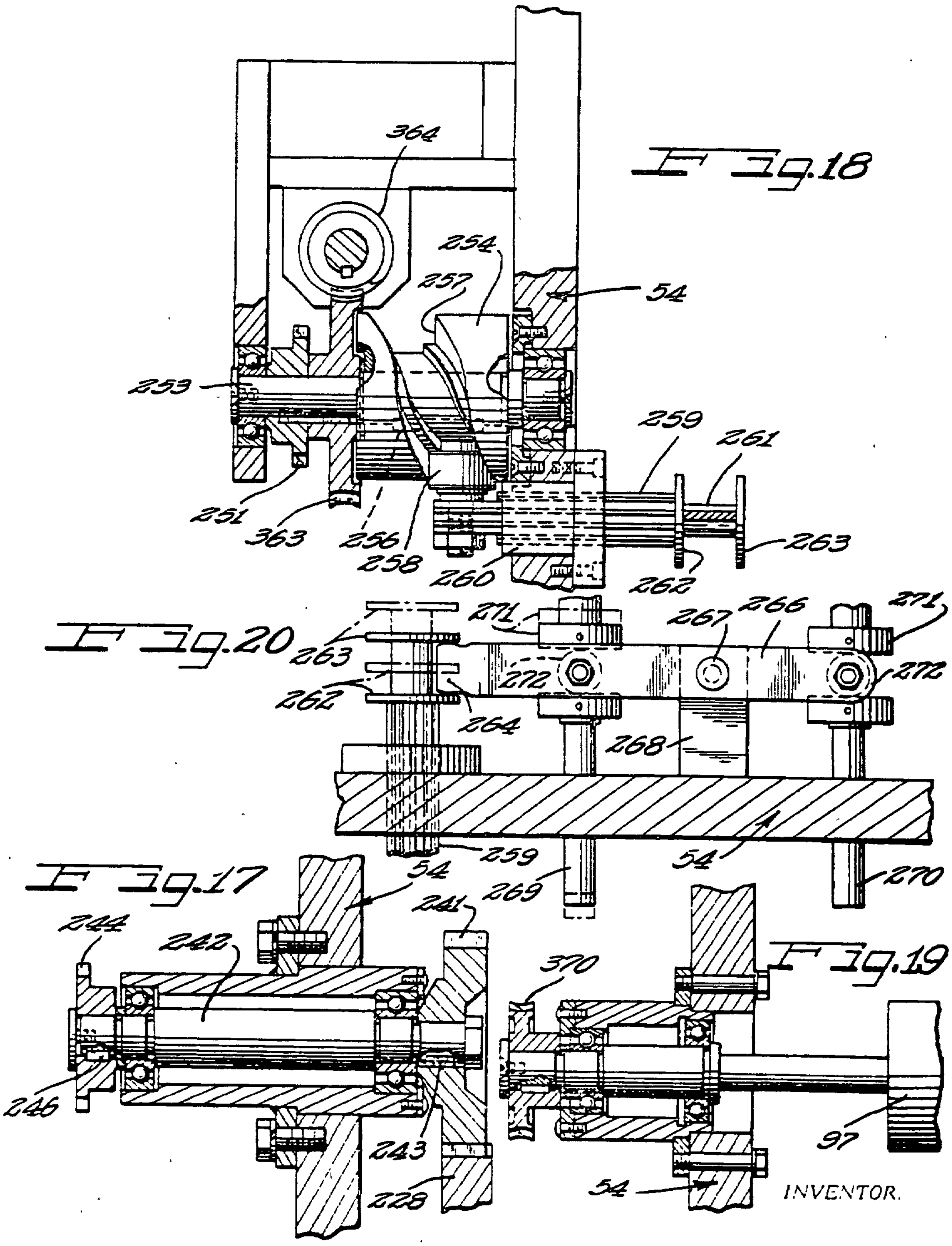

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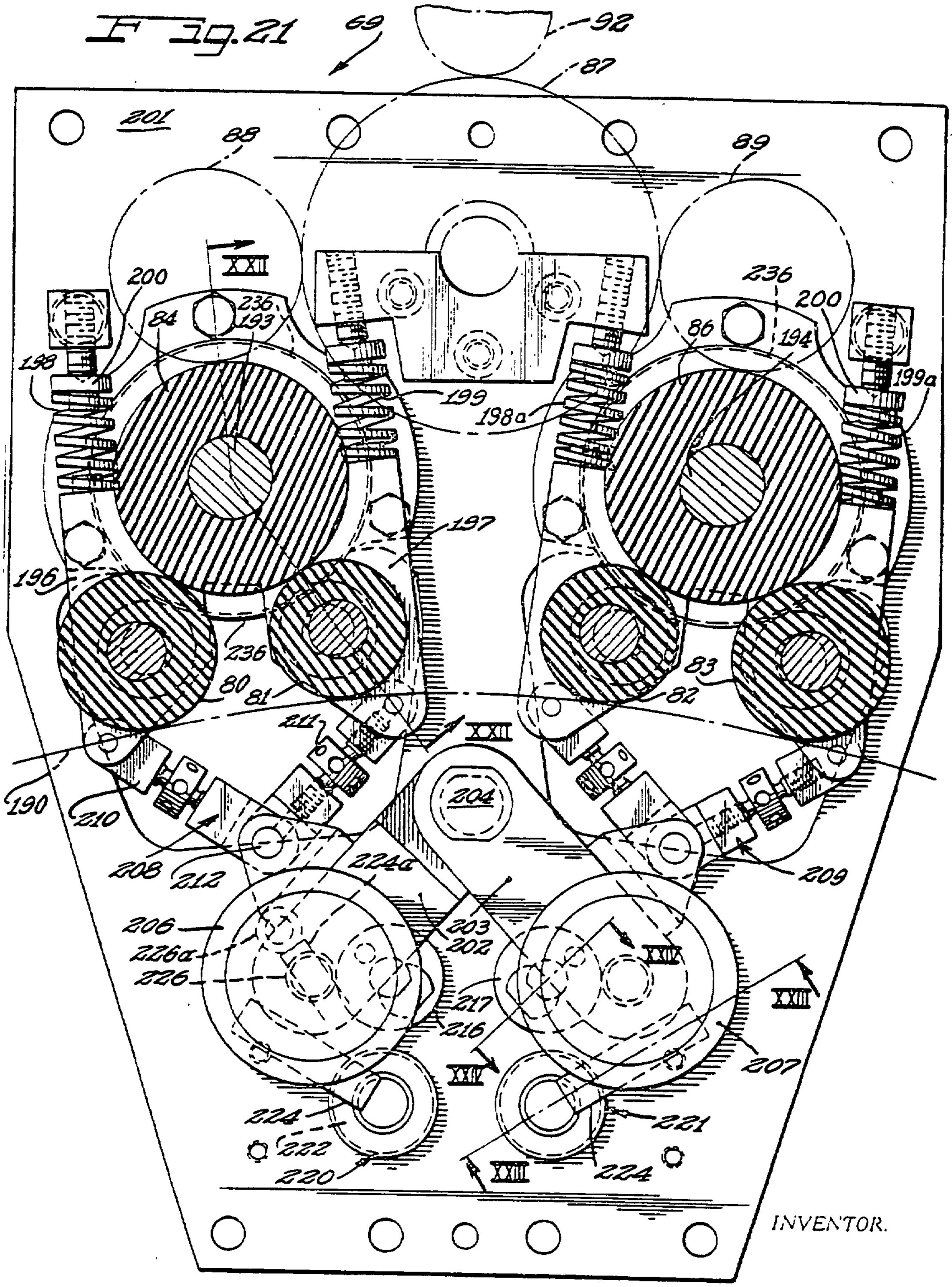
Fig. 21



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W019072

Patented Oct. 27, 1970

3,536,006

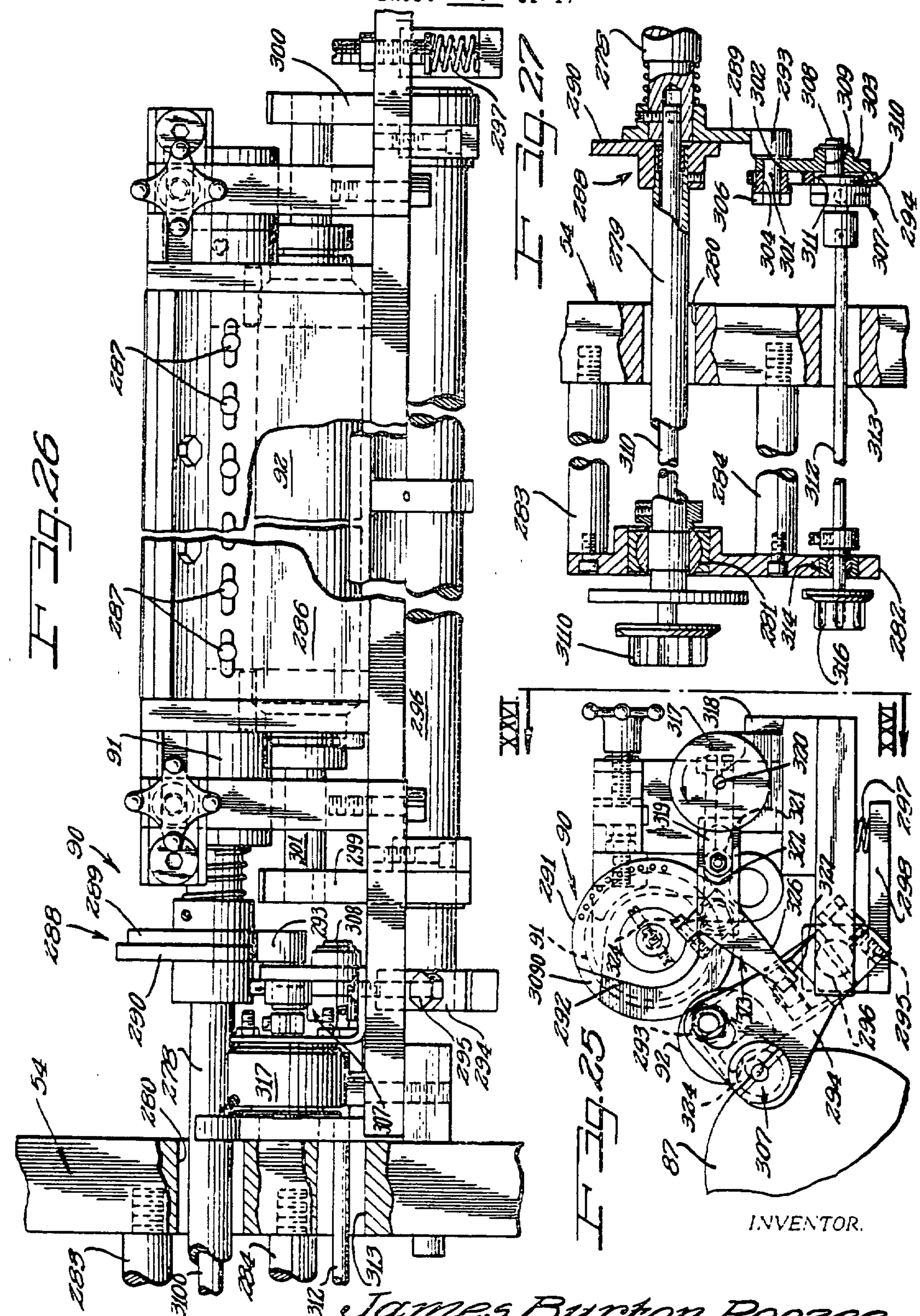

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FIG. 28

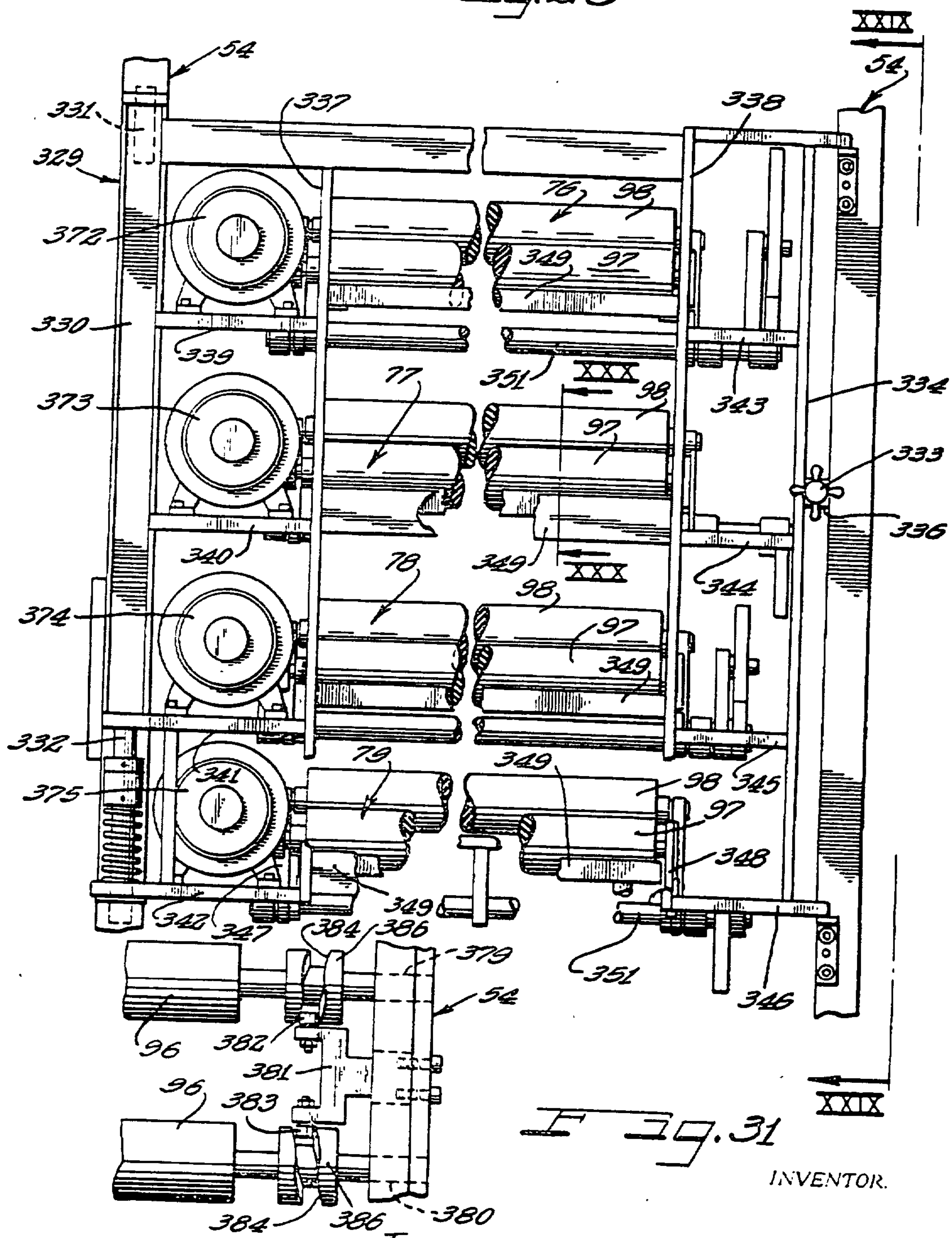

FIG. 31

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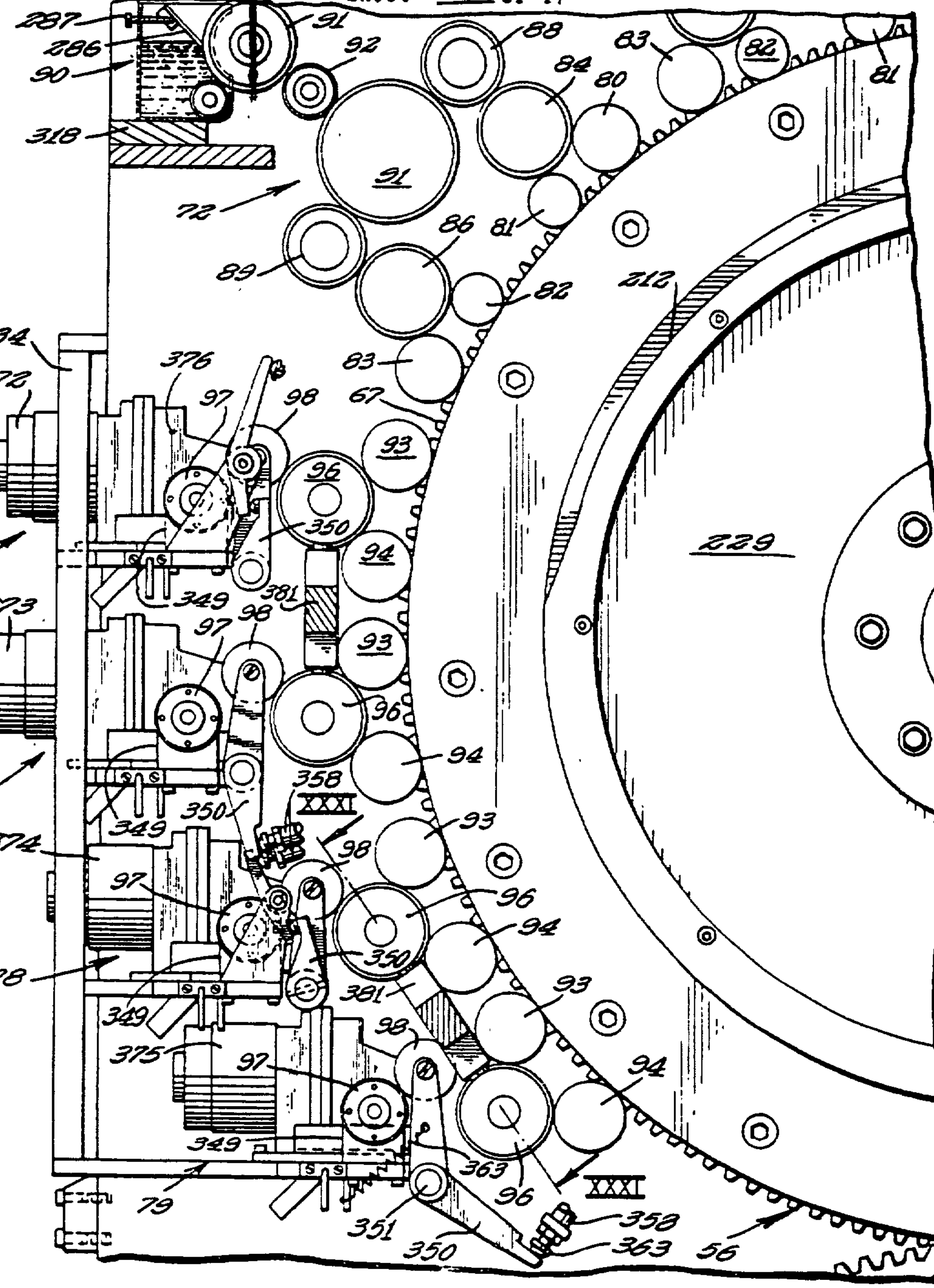

Fig. 29

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Fig. 33

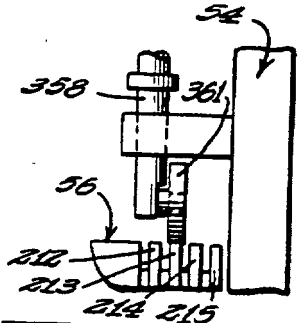


Fig. 32

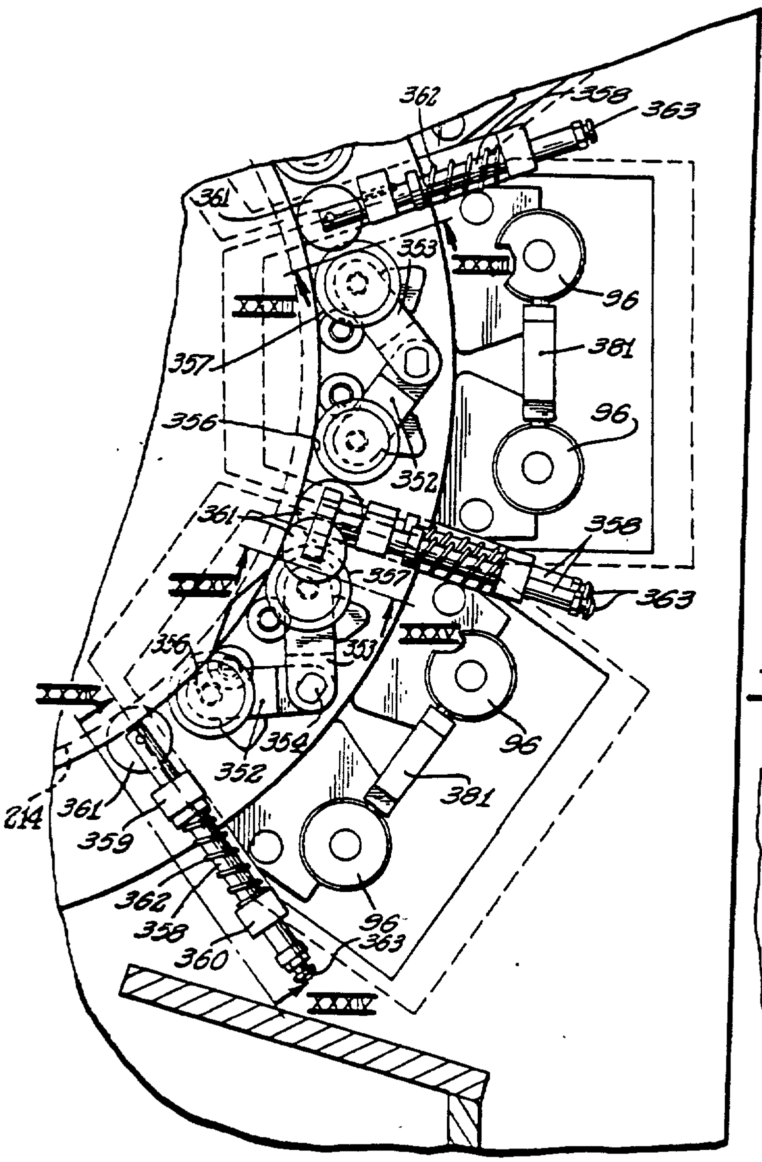


Fig. 34

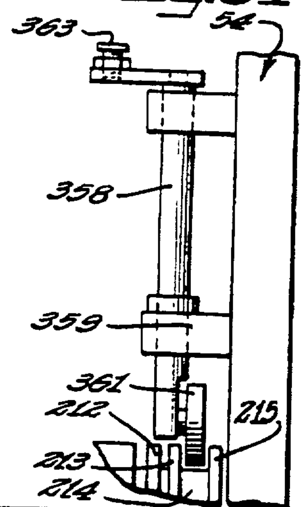
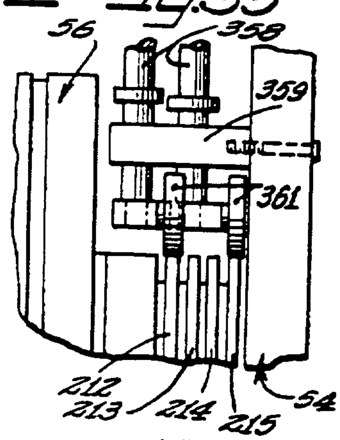


Fig. 35



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MULTICOLOR ROTARY OFFSET PRINTING PRESS WITH CYLINDER INTERRUPTION

BACKGROUND OF THE INVENTION

This invention relates generally to printing presses and more particularly to the field of multicolor rotary offset printing presses.

Printing presses of this general category are known in the art. See, for example, Firm U.S. Pat. No. 1,025,258. Generally such presses employ multiple plate cylinders in multiple color applications, although my copending application Ser.No. 464,784 filed June 17, 1965, now U.S. Pat. No. 3,347,160, discloses a multicolor press having a single plate cylinder, a single blanket cylinder and a single impression cylinder

SUMMARY OF THE INVENTION

The present invention employs a single plate cylinder which is circumferentially divided into various color segments which equal in number the number of colors to be printed on the press. The embodiment of the invention disclosed herein comprises a four-color press but the principles of the present invention are applicable to a multicolor rotary offset press regardless of the number of colors the press is designed to accommodate.

The blanket cylinder is located directly below the plate cylinder and is equal in diameter to the plate cylinder The impression cylinder is spaced horizontally from the blanket cylinder and has a diameter equal to one quarter the diameter of the blanket cylinder since the impression cylinder rotates four times for each revolution of the blanket cylinder

In normal four-color operation all four-color segments of the plate cylinder engage corresponding segments of the blanket cylinder during each revolution of the two cylinders, and the impression cylinder similarly engages the corresponding four-color segments of the blanket cylinder for printing all four colors. However the present invention contemplates the provision of means for tripping the blanket cylinder out of printing engagement with the plate cylinder and the impression cylinder out of printing engagement with the blanket cylinder for omitting one or more of the four colors from the final printed sheet.

A plurality of inking and dampening systems are disposed around a portion of the periphery of the plate cylinder and include means for moving their respective ink and water dampener rolls into engagement only with their corresponding color segments of the plate cylinder. In the event one (or more) of the colors is to be omitted, however, means is provided for maintaining the corresponding ink and dampener rolls completely out of engagement with their respective color segment of the plate cylinder

In order to trip the blanket cylinder between the print and trip positions thereof a pair of elongated arms are pivotally mounted at one of the ends thereof to the frame of the press for supporting and journaling the blanket cylinder in the order of second class levers The opposite ends of the arms are connected to an eccentric shaft which is rotated by cooperating cam and cam follower members operatively interconnecting the blanket cylinder and the eccentric shaft. The impression cylinder is mounted on an eccentric shaft for movement between its print and trip positions with respect to the blanket cylinder and cam and cam follower means also operatively interconnect the blanket cylinder and the eccentric shaft which journals the impression cylinder. By virtue of this arrangement the blanket and impression cylinders are moved between their print and trip positions accurately and without undue vibration of the press. The blanket cylinder is also spring biased into the plate cylinder for selectively controlling the nip pressure of the print couple therebetween Electric solenoids are provided for selectively holding the blanket and impression cylinders in the print positions When the solenoids for one or more colors are not energized, the blanket and impression cylinders are moved by springs from the print position which they always assume in the gap between each plate, to the trip position thereof for omitting one or more of the colors of the press.

Each of the inking and dampening systems comprises a vibrator roll for applying the ink or water evenly to a pair of ink or dampener rolls which actually engage the plate cylinder. The plate engaging rolls are movable into and out of engagement with the plate cylinder while maintaining continuous contact with their corresponding vibrator roll. A cam and cam follower arrangement interconnects the plate cylinder and the plate engaging rolls so that the movement of the rolls is synchronized with rotation of the plate cylinder and so that each of the plate engaging rolls contacts only its corresponding color segment of the plate cylinder Electric solenoids are also provided for holding the plate engaging rolls out of contact with the plate cylinder when one or more of the colors is to be omitted.

Each of the dampening systems comprises a fountain roll which turns continuously but at a speed which varies nonlinearly with respect to variations in the speed of the plate cylinder A transfer roller oscillates back and forth between the fountain roll and a vibrator roll during each revolution of the plate cylinder. The motor driven fountain rolls are mounted on a door member which in turn is pivotally mounted on the frame of the press for greater accessibility to the fountain rolls and their associated fountains and transfer rollers as well as for greater accessibility to the vibrator rolls and the plate cylinder itself

The overall arrangement as well as specific features embodied in the present invention provides for increased press speed, simplified construction, improved printing characteristics, reduced overall size, improved performance and a longer useful life Ease of operation and maintenance are important advantages of the present invention.

It is, therefore, an object of the present invention to provide a multicolor rotary offset printing press having a single plate cylinder mounted on a fixed axis, a single blanket cylinder and a single impression cylinder and means for tripping the blanket cylinder into and out of engagement with the plate cylinder and for tripping the impression cylinder into and out of engagement with the blanket cylinder

Another object of the invention is to provide improved means for tripping the blanket and impression cylinders

Another object is to provide an improved inking system for a multicolor rotary offset press

Another object is to provide an improved dampening system for a multicolor rotary offset press

Another object is to provide a dampening system comprising a fountain roll, a transfer roller and a vibrator roll in which the transfer roller oscillates between the fountain roll and the vibrator roll during each revolution of the plate cylinder and remains in contact with each of the rolls during a fixed angle of rotation of the plate cylinder The speed of rotation of the fountain roll is nonlinearly variable with respect to the speed of rotation of the plate cylinder to accommodate variations in requirements in the transfer of water to the plate cylinder as the speed of the plate cylinder varies.

Another object of the present invention is to provide a multicolor rotary offset press wherein the blanket cylinder and the impression cylinder are moved from print to trip positions by mechanical means but are selectively maintained in such print positions by electromechanical means.

Another object is to provide a multicolor offset press wherein the plate-engaging rolls of the inking and dampening systems are moved out of engagement with the plate cylinder by mechanical means but are selectively maintained in the disengaged positions thereof by electromechanical means

Another object of the invention is to provide a more compact multicolor rotary offset printing press with increased printing speed and ease of operation and high performance printing characteristics.

Many other features, advantages and additional objects of the present invention will become manifest to those versed in the art upon making reference to the detailed description

which follows and the accompanying sheets of drawings, in which preferred structural embodiments incorporating the principles of the present invention are shown by way of illustrative example only.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG 1 is a perspective view of a multicolor rotary offset printing press constructed in accordance with the principles of the present invention with certain parts removed and others shown in section for purposes of clarity and to show the relative disposition of parts.

FIG. 2 is an elevational view of one side of the press with certain of the basic parts indicated in dashed lines to show the overall arrangement thereof.

FIG. 3 is an enlarged fragmentary elevational view of the press taken from the same side as FIG 2 and with parts omitted to emphasize portions of the blanket and impression cylinder supporting and tripping assemblies.

FIG 4 is similar to FIG. 3 but is taken from an opposite side of the press.

FIG. 5 is a fragmentary horizontal substantially sectional view taken along lines V–V of FIG 4

FIG 6 is a vertical view taken along lines VI–VI of FIG 4 with certain parts shown in section and other parts removed to simplify the drawing.

FIG 7 is a vertical sectional view taken along line VII–VII of FIG 4.

FIG 8 is a vertical sectional view taken along line VIII–VIII of FIG. 4.

FIG 9 is an enlarged elevational view of portions of the impression cylinder supporting and tripping assembly shown in FIG 3.

FIG 10 is an enlarged elevational view of portions of the blanket cylinder supporting and tripping mechanism locked in their printing positions shown in FIG 4

FIGS. 11 and 12 are taken along lines XI–XI and XII–XII, respectively, of FIG 10

FIG. 13 is a front elevational view of the plate cylinder of the illustrated embodiment of the invention with portions thereof shown in section.

FIG 14 is a side elevational view of the plate cylinder taken along XIV–XIV of FIG. 13.

FIG. 15 is a side elevational view of the plate cylinder with a plurality of inking and dampening systems arranged therearound, some parts thereof having been removed and others being shown in phantom lines for clarity.

FIG. 16 is an enlarged cross-sectional view of an inking roll and dampener roll drive arrangement taken along line XVI–XVI of FIG 15.

FIG. 17 is an enlarged cross-sectional view of another drive arrangement for driving the ink vibrator rolls and ink fountain rolls and is taken along line XVII–XVII of FIG 15.

FIG. 18 is a cross-sectional view of a drive arrangement interconnecting the ink vibrator rolls and the ink fountain rolls and taken along line XVIII–XVIII of FIG 15

FIG. 19 is a cross-sectional view of the ink fountain roll drive assembly taken along line XIX–XIX of FIG. 15

FIG. 20 is a fragmental elevational view of a walking beam assembly associated with the ink vibrator rolls and taken along line XX–XX of FIG. 15

FIG. 21 is an enlarged view of an inking system partly in section and partly in elevation and identified in FIG. 15 in the area encircled at XXI–XXI.

FIGS. 22, 23 and 24 are sectional view taken along lines XXII–XXII, XXIII–XXIII and XXIV–XXIV respectively, of FIG. 21.

FIG. 25 is an enlarged side elevational view of an ink fountain system of the present invention and is identified in FIG 2 in the area encircled at XXV–XXV

FIGS 26 and 27 together comprise a front elevational view of the ink fountain systems taken along line XXVI–XXVI of FIG 25, FIG. 27 being an extension of the left end of FIG 26

FIG 28 is a front elevational view of the dampening systems taken along line XXVIII–XXVIII of FIG. 2.

FIG. 29 is a side elevational view of the dampening systems taken along line XXIX–XXIX of FIG. 28.

FIG. 30 is a cross-sectional view of the fountain roll and transfer roller of one of the dampening systems taken along line XXX–XXX of FIG. 28.

FIG 31 is a fragmentary elevational view of the vibrator rolls of one of the dampening systems taken along lines XXXI–XXXI of FIG. 29.

FIG. 32 is a side elevational view of the dampening systems showing some of the rolls in phantom lines for clarity and showing portions of the cam follower members shown in FIG 29 for oscillating the transfer rollers of the dampening systems.

FIGS. 33, 34 and 35 are elevational views taken along lines XXXIII–XXXIII: XXXIV–XXXIV and XXXV–XXXV of FIG. 32.

FIG. 36 is a schematic wiring diagram of the plate cylinder and dampening system fountain roll electric drive arrangements.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG 1, reference numeral 50 indicates generally a multicolor rotary offset printing press constructed in accordance with the present invention The press 50 may be used either as a production or a proof press since the principles of the present invention are applicable equally to both types of presses.

GENERAL ARRANGEMENT

In order to facilitate an understanding of the invention the general arrangement thereof will be described at the outset

The press 50 comprises a press frame 51 having a pair of spaced parallel vertical wall members 52 and 53 Included in each of the wall members 52 and 53 is a heavy plate as indicated at 54 which forms an internal wall surface and which together bear the major portion of the weight of the press

Extending between the wall plates 54, 54 on spaced parallel horizontal axes are a plate cylinder 56, a blanket cylinder 57 and an impression cylinder 58 The plate cylinder 56 is of the circumferentially segmented type that is, it is divided around the circumference thereof in spaced portions equal in number to the number of colors which the illustrated embodiment of the press 50 is arranged to accommodate In the illustrated embodiment the press 50 is arranged to accommodate four colors, and thus the plate cylinder is circumferentially divided into four color segments Each of the segments receives a plate for printing one of the four colors, as will be understood by those skilled in the art

The blanket cylinder 57 is disposed directly vertically below the plate cylinder 56 and is of the same diameter as is the plate cylinder so that each of the four quadrants of the blanket cylinder 57 receives the ink transferred from one of the four plates of the plate cylinder The impression cylinder 58 is situated to one side of the blanket cylinder 57 and has a diameter which is equal to one-quarter of the diameter of the plate cylinder 56 and the blanket cylinder 57.

The press frame 51 may be characterized as comprising a front side 59 and a rear side 60 The impression cylinder 58 is disposed at the front side of the press frame 51 with respect to the blanket cylinder 57

The plate cylinder 56, the blanket cylinder 57 and the impression cylinder 58 are all journaled for rotation on the press frame 51 They are also drivingly interconnected for joint rotation, that is, the rotation of all of the cylinders occurs simultaneously

The main power source for operating the press 50 comprises an electric motor 61 mounted on the wall member 53 and connected to a main drive gear 62 through a speed reducer 63 The gear 62 is in mesh with a gear 64 formed on the blanket cylinder 57 which in turn is in mesh with a gear 66

formed on the impression cylinder 58 and another gear 67 formed on the plate cylinder 56.

Also situated at the front side 59 of the press frame 51 is a paper feeder and stacking assembly indicated generally at reference numeral 68. The assembly 68 may be of a type known in the art and need not be described herein in detail but performs the function of feeding the blank paper sheets to the impression cylinder 58 and then receiving and stacking the printed sheets as they are released from the impression cylinder. Disposed around the periphery of the plate cylinder 56 and extending generally from the upper quadrant of the plate cylinder near the rear side 60 of the press frame 51 to the lower quadrant at the front side 59 of the frame 51 are a plurality of plate cylinder inking and dampening systems. Since the illustrated embodiment of the invention comprises a four-color press there are four inking systems, one for each color, indicated respectively at reference numerals 69, 70, 71 and 72. There are also four dampening systems, one for each color, and these are indicated generally at reference numerals 76—79, respectively.

The four inking systems 69—72 are identical in most basic respects, although it may be noted in FIG. 2 that the relative disposition of some of the parts thereof are reversed merely to maintain optimum compactness of the press 50 and to enhance the overall design and construction thereof.

Briefly, each of the inking systems comprises two pairs of ink rolls, which rolls are indicated respectively in connection with inking system 69 at reference numerals 80, 81, 82 and 83. The ink rolls 80—83 actually engage the plate mounted on the plate cylinder 56 which corresponds to the color of ink being applied by the inking system 69. Also included are a pair of vibrator rolls 84 and 86, each of which engages a pair of the ink rolls 80—83.

Inking system 69 also includes an ink drum 87 and a pair of doctor rolls 88 and 89 interposed respectively between vibrator rolls 84 and 86 and the ink drum 87. The ink is supplied to the ink drum 87 from an ink fountain 90 through a fountain roll 91, which rotates on a fixed axis, and a transfer roller 92 which pivots back and forth between the fountain roll 91 and the ink drum 87 to transfer ink in desired amounts from the fountain roll 91 to the ink drum 87 and then, through the doctor rolls 88 and 89 and vibrator rolls 84 and 86 to the ink rolls 80—83.

All of the dampening systems 76—79 are similar to one another although it is noted that some slight modifications from one dampening system to another have been made once again in the interest of optimum overall press design. The dampening system 79, for example, includes a pair of dampener rolls 93 and 94 which actually engage one of the four plates mounted on the plate cylinder 56 and corresponding thereto in terms of one of the four colors which may be printed on the press 50. Also included is a vibrator roll 96 which engages the dampener rolls 93 and 94, a fountain roll 97 which rotates on a fixed axis and a transfer roller 98 which pivots back and forth between the fountain roll 97 and the vibrator roll 96. The purpose of the dampening systems 76—79 is to add a slight film of water to the various plates of the plate cylinder 56 before the plates are inked by the inking systems 69—72. Each of the dampening systems 76—79 applies water only to one of the four plates, just as each of the inking systems 69—72 applies its particular color of ink to only one of the plates. Thus there is one dampening system and one inking system for each of the four plates of the four-color press illustrated herein.

In operation, a stack of blank sheets to be printed, as shown at reference numeral 98, is placed on a bed 99 of the paper feeder and stocking assembly 68. The operator may ascend a ladder 100 to visually inspect the upper reaches of the press to ensure proper readiness and then may start the press by actuating suitable switches and other control devices mounted on a control panel 101 on the wall member 53. Access doors 102 are also mounted on the wall member 53 for access through an outer panel 103 for making other adjustments that may be desirable.

The main drive motor 61 is energized to drive the plate cylinder 56, the blanket cylinder 57 and the impression cylinder 58 jointly, and through suitable power takeoffs, also to drive the inking systems 69—72 as well as the dampening systems 76—79. A power takeoff indicated generally at reference numeral 104 drives the paper feeder and stacking assembly 68 from the impression cylinder 58 as a result of which movable arm members indicated at 106 feed the sheets from the stack 98 to the impression cylinder 58 seriatim.

The impression cylinder 58 is equipped with grippers to grip each sheet as it is received from the assembly 68 and to carry the sheet through four revolutions of the impression cylinder 58 before the sheet is released in printed form to a stacking plate indicated at 107. As each sheet revolves four times on the impression cylinder 58 the four colors of ink from the blanket cylinder 57 are transferred thereto. During this time the blanket cylinder 57 and the plate cylinder 56 each turn one revolution, each of the four quadrants or color segments of each serving to print one of the four colors.

As shown in FIGS. 13 and 14, the four-color segments of the plate cylinder 56 are identified at reference numerals 73a, 73b, 73c and 73d. Each of the four segments are equipped with two pairs of clamping devices 74a and 74b for securing the ends of its respective plate thereto. Note that there exists a gap between the adjacent segments 73a—73d to provide recesses in which the clamps 74a and 74b are disposed. As a result of these gaps similar spaces occur on the periphery of the blanket cylinder 57 during operation of the press between the color segments thereof which receive the ink transferred thereto from the four plates of the plate cylinder 56.

BLANKET CYLINDER TRIPPING MECHANISM

Occasion may arise from time to time in the operation of the press 50 when less than all four of the colors are to be used. For example, some types of printed work may require merely black ink and red ink while another application may require black, red and yellow color inks. The press 50 is constructed and arranged to accommodate printing of all four colors or of any number less than four. To this end means are provided for moving the blanket cylinder 57 out of printing engagement with the plate cylinder 56 during rotation of the two cylinders through one or more quadrants or color segments corresponding to one or more of the colors to be omitted. The impression cylinder 58 is also moved out of printing engagement with the blanket cylinder 57 during any revolution thereof corresponding to an omitted color. In other words, during operation of the press with less than all four colors printing the blanket cylinder moves to a nonprint or trip position, i.e. out of printing engagement with the plate cylinder 56, during that angle of rotation of the blanket and plate cylinders corresponding with the omitted color or colors. The blanket cylinder 57 returns to a print position at which it engages the plate cylinder 56 in printing relation at the nip or printing couple formed with the plate cylinder 56 as the two cylinders rotate through the quadrants or color segments corresponding to the colors being printed.

To confer upon the blanket cylinder 57 this ability to move or jog back and forth between a print and a trip position with respect to the plate cylinder 56 the blanket cylinder 57 is mounted on a tripping mechanism indicated generally at reference numeral 108. Referring to FIGS. 3—8, the tripping mechanism 108 may be more particularly characterized as comprising a pair of elongated lever arms 109 and 110 which are pivotally mounted respectively at one of the ends thereof on the heavy wall plates 54 54 by means of a pair of pivot pins 111 and 112 which, as shown in FIG. 5, extend through their corresponding wall plates 54 and are fixedly secured thereto. The blanket cylinder 57 comprises a shaft 113 which extends outwardly from a pair of end walls 114 and 116 and is journaled for rotation on the shaft 113, the shaft being fixed at the ends thereof on the elongated lever arms 109 and 110.

Mounted on each of the lever arms 109 and 110 at an end opposite its corresponding pivot pin 111 and 112 is a trip

block 117 as shown in FIGS. 4, 5 and 8. Each of the trip blocks 117 comprises an L-shaped plate 118 which forms an extension of its respective lever arm 109 and 110. The plate 118 is connected in fixed assembly to a lower one of a pair of horizontally split block plates 119 and 120 so that the lower block plate 120 moves with its respective lever arm whereas the upper block plate 119 may move relative thereto

A pair of linking studs 121 and 122 are threaded at their lower ends into a journal member 123 and extend at their upper ends through registered bores formed in the upper and lower block plates 119 and 120 as indicated at 124 and 126. The diameter of bores 124 is reduced compared to the diameter of bores 126 and the studs 121 and 122 are also reduced in diameter to provide a shoulder 127 abutting a bottom wall 128 of the upper block plate 119

An upper end 186 of each of the linking studs 121 and 122 is threaded as at 186 to receive a washer 187 and a complementarily threaded nut 188 for securing the studs 121 and 122 within the bores 124 of the upper block plates 119.

An eccentric shaft 129 is received in semicircular recesses 130 and 131 formed respectively in the bottom wall of the upper block plate 124 and in a top wall 132 of the lower block plate 120. An eccentric stub 133 of the shaft 129 is received in a bore 134 formed in the L-shaped plate 118 and is connected in fixed assembly to an adjustment plate 136 which may be pivoted and locked by suitable means such as a threaded bolt 137.

Also mounted on the linking studs 121 and 122 are heavy-duty helical springs 138 and 139 which are bottomed at one end thereof on threaded sleeves 140 and bottomed at the other end thereof on an underside 141 of the lower block plate 120.

The heavy wall plates 54,54 of the press frame 51 are apertured respectively as at 142 to enable the shaft 113 of the blanket cylinder 57 to extend therethrough and the aperture is oversized to enable the shaft 113 to move freely therewithin as the blanket cylinder 57 is pivoted between the print and trip positions thereof.

The journal member 123 into which the linking studs 121 and 122 are threaded is mounted on an eccentric 143 of a shaft 144 extending between and journaled for rotation on the heavy wall plates 54,54 Extending from the shaft 144 and keyed at 146 for joint rotation therewith is an arm member 147 connected to a trip arm 148 through an intermediate linkage 149 pivotally connected at the ends thereof to the arm member 147 and the trip arm 148. The trip arm 148 is, in turn, pivotally mounted at 150 to a wall plate 54 of the press frame 51.

The trip arm 148 is biased in a counterclockwise direction as viewed in FIG. 10 by a heavy spring 151 which is bottomed at one end 1520 on the wall plate 54 and at an opposite end 1530 on the trip arm 148. A cam follower 1540 also projects from one side of the trip arm 148

A series of cam members indicated respectively at reference numerals 152, 153, 154 and 155 which are mounted on one of the end walls 114 of the blanket cylinder 57 also comprise the blanket cylinder tripping mechanism The cam members 152—155 are spaced 90° about the axis of the blanket cylinder and are spaced radially to engage the cam follower 1540 mounted on the trip arm 148 and move the trip arm 148 clockwise against spring 151 as the blanket cylinder 57 rotates. Thus for each revolution of the blanket cylinder 57 the trip arm 148 will, unless locked in "print" position by a hereinafter described solenoid, jog or pivot the eccentric shaft 144 a total of four times, during each of which periods the journal member 123 is moved slightly downwardly to pivot lever arms 109 and 110 in a manner to move the blanket cylinder 57 into a trip position or out of printing engagement with the plate cylinder 56. As each of the respective cams 152—155 rotates past the cam follower 1540 the spring 151 pivots the trip arm 148 to rock or rotate the eccentric shaft 144 in an opposite direction to move the blanket cylinder 57 back to a trip position with respect to the plate cylinder 56

The cam surfaces 152—155 are constructed and arranged to printing the blanket cylinder 57 to a trip position just as each of the four corresponding color segments of the plate cylinder 56 and the blanket cylinder 57 enters the printing couple defined by the nip between the two cylinders, that is, in a gap between adjacent color segments. In order to maintain the blanket cylinder 57 in a print position for any one or all of the four color segments of the plate and blanket cylinders electric solenoid means indicated generally at reference numeral 156 are provided to lock the trip arm 148 in a print position as shown in FIG. 10. In the illustrated embodiment thereof, the electric solenoid means 156 comprises a rotary solenoid 157 mounted on the wall plate 54 and having a pivotal arm 158 which pivots between two positions as the rotary solenoid 157 is energized and deenergized. Mounted on the end of the arm 158 is a rotatable shaft 159 having an enlarged head 160 housed in an elongated groove 161 formed in a bushing 162. The bushing 162 is mounted on a shaft 163 which extends through and is journaled by the wall plate 54 and which has mounted on an opposite end thereof a locking arm 164.

Formed on the distal end of the locking arm 164 is a boss 166 which, in the energized or print, position of the rotary solenoid 157 engages an abutment wall 167 formed at the distal end of the trip arm 148 to prevent the trip arm from pivoting counterclockwise under the force of spring 151 as viewed in FIG. 10 to return the blanket cylinder 57 to the trip position thereof.

It is noted that the power of the rotary solenoid 157 need not be sufficient to move the trip arm 148 against the bias of spring 151 to a print position since the trip arm is moved to the print position by the cams 152—155 on the blanket cylinder 57 acting on the cam follower 154. Further, cams 152—155 are so constructed and arranged to move the abutment wall 167 off of the boss 166 at the high points of cams 152—155 to facilitate easy operation and turning of the rotary solenoid 157

The solenoid 157 is wired to suitable switch means in the control panel 101 to pivot to the print position thereof shown in FIG. 10 and to maintain the blanket cylinder 57 in a print position for one or more of the four color segments or quadrants of the blanket cylinder. For example, if three colors are being printed, the rotary solenoid 157 will be deenergized so as to automatically rotate to the trip position thereof (a position where it is rotated counterclockwise from the position shown in FIG 10) as that quadrant of the blanket cylinder corresponding with the omitted color rotates along with the plate cylinder 56 to form the printing nip or couple therebetween As soon as that quadrant of the corresponding omitted color rotates beyond the printing couple the cam follower 1540 is tripped by the next succeeding cam 152—155 to move trip arm 148 to the print position and the rotary solenoid 157, which has just been energized is pivoted toward the abutment wall 167 to enable the trip arm 148 and the blanket cylinder 57 to be retained in the print position shown in FIG 10 for the next three succeeding quadrants of the blanket cylinder 57.

In the print position thereof the blanket cylinder 57 is biased into printing engagement with the plate cylinder 56 by the heavy-duty helical springs 138 and 139 and the nuts 188 and washers 187 which are actually raised slightly off of the upper block plates 119. Thus a predetermined nip pressure is provided at the printing couple between the plate cylinder 56 and the blanket cylinder 57 This nip pressure can be selectively varied by adjustably rotating the eccentric shaft 129 by means of the adjustment plate 136 and then locking it in place with a locking nut 189 The use of springs 138 and 139 accommodates the slight movement of abutment wall 167 away from boss 166 at the high points of cams 152—155 and also precludes damage to the press that may otherwise result from an increased thickness in the plates on the plate cylinder 56

It may be noted in FIG. 10 that a stop 191 which, in the illustrated embodiment, comprises an eccentric shaft is

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mounted on wall plate **54** and comprises an offset stub **191**a located in the pivotal path of travel of an adjacent side **148**a the trip arm **148**. By adjusting the angular disposition, of the shaft **191** and varying the position of the stub **191**a the counterclockwise movement of the trip arm **148** is limited.

IMPRESSION CYLINDER TRIPPING MECHANISM

As noted, a tripping mechanism for the impression cylinder **58** is also provided in order to move the impression cylinder **58** to a trip position, that is, out of printing engagement with the blanket cylinder **57**, during each of the four revolutions of the impression cylinder **58** which correspond to the four color segments of the blanket cylinder **57**.

Referring to FIGS. 3 and 9, the impression cylinder tripping mechanism is indicated generally at reference numeral **168** and comprises an eccentric shaft **169** extending between and journaled on the wall plates **54, 54** of the press frame **51** and mounting thereon for joint rotation therewith the impression cylinder **58**. Thus as the eccentric shaft **169** rotates or oscillates slightly back and forth the impression cylinder **58** is moved back and forth between the print and trip positions thereof with respect to the blanket cylinder **57**

The tripping mechanism **168** is more particularly characterized as comprising a pair of arms **170** and **171** pivotally mountec on the wall plate **54**. Arms **170** and **171** are interconnected by a linkage **172** and the arm **170** is connected to the eccentric shaft **169** by a linkage **173**

Mounted on a shaft **174** on which arm **171** rotates is mounted a cam follower **176** situated in the path of travel of and arranged to be engaged by each of the cam members **152—155** as the blanket cylinder **57** is rotated Thus in the gap between each of the color segments or quadrants of the blanket cylinder **57** the impression cylinder is moved to a print position In order to maintain the impression cylinder **58** in print position for any one or more of the color quadrants of the blanket cylinder **57** an electric solenoid locking means **177** is mounted on the wall plate **54**

Referring to FIG 9, the illustrated embodiment of the locking means **177** comprises an electric rotary solenoid **178** having a pivotal arm **179** enlarged at the end thereof as at **180** to be received in a slot **181** of a pivotal arm **182**. An end wall **183** of arm **182** forms an abutment wall for engaging in face-to-face contact another abutment wall **184** formed on a flange **186** which rotates with the eccentric shaft **169**. Thus the impression cylinder **58** is moved to a print position at the beginning of each revolution thereof and is maintained in such print position by actuation of the rotary solenoid **178** if the particular color to which that revolution corresponds is desired If a color is to be omitted, the solenoid **178** is deenergized so as to permit the arm **179** to move to its trip position As in the case of rotary solenoid **157** of the blanket cylinder tripping mechanism the power requirements of the rotary solenoid **178** need merely be sufficient to pivot the arm **179** since the abutment wall **184** is tripped out of abutting engagement with the end wall **183** by the action of cams **152—155** against cam follower **176**. The rotary solenoid **178** is, of course, suitably interconnected with the switching mechanism in the control panel **101** for automatic energization and deenergization thereof as the number of printed colors of the press is changed

INKING SYSTEMS

As noted, the illustrated embodiment of the press **50** comprises four independent inking systems **69—72** for the four colors of the press As shown in FIG 15 each of the inking systems **69—72** has a generally wedge-shaped configuration in side elevation and since all of the wedges or inking systems are substantially identical with one another it is necessary that only one be described in detail

Referring to the enlarged sectional view of the wedge-inking system **69** in FIG 21 a total of four ink rolls **80—83** are disposed adjacent the periphery of the plate cylinder **56**, such periphery being indicated by the dashed line at reference numeral **190**. Ink rolls **80** and **81** engage a vibrator roll **84** and ink rolls **82** and **83** engage another vibrator roll **86**. The vibrator rolls **84** and **86** are mounted respectively on shafts **193** and **194** which extend between and are journaled for rotation on the wall plates **54, 54** of the press frame **51**. The ink roll **80** is rotatably mounted at the ends thereof on a pair of mounting plates situated respectively within the wall members **52** and **53** of the press frame **51**, only one of which is shown in FIG. **21** at reference numeral **196**. The mounting plate **196** is, in turn, rotatably mounted on the shaft **193** of the vibrator roll **84** so that the ink roll **80** can move about the periphery of the vibrator roll **84** while maintaining constant engagement therewith. Similarly ink roll **81** is rotatably mounted on a mounting plate **197** also journaled on the shaft **193** of the vibrator roll **84** whereby the ink roll **81** can also pivot or move about the periphery of the vibrator roll **84** while maintaining engagement therewith.

The ink rolls **80** and **81** are biased in the direction of the periphery **190** of the plate cylinder **56** by means of a pair of spring members **198** and **199** which are bottomed at one end against an adjustable abutment **200** mounted on a wedge-shaped plate **201** which in turn is mounted on one of the heavy wall plates **54, 54** of the press frame **51**. The other end of the springs **198** and **199** are bottomed on their respective mounting plates **196** and **197** The ink rolls **82** and **83** are similarly mounted and are also biased in the direction of the plate cylinder periphery **190** by springs **198**a and **199**a respectively

Also mounted on the wedge-shaped plate **201** are a pair of cam follower arms **202** and **203** which are journaled for pivotal movement on a pin **204** Rotatable disc-shaped urethane-covered cam followers **206** and **207** are mounted on the arms **202** and **203** adjacent the distal ends thereof

A pair of toggle joints **208** and **209** interconnect the arms **202** and **203** with the mounting plates **196** and **197** of their respective ink rolls For example, toggle joint **208** comprises a pair of linkages **210** and **211** pivotally connected to the mounting plates **196** and **197** and a pivot pin **212** mounted on the arm **202** The linkages **210** and **211** comprise turnbuckles for adjustably varying the distances between the ink rolls and the periphery or plates of the blanket cylinder **57** in the trip positions of the ink rolls

Referring to FIGS 13, 14 and 21 the cam followers **206** and **207** of each of the inking systems **69—72** are in radial alignment with one another to engage one of four axially spaced cam surfaces **212, 213, 214** and **215** formed at opposite ends of the plate cylinder **56** In other words the two cam followers **206** and **207** of each of the inking systems **69—72** engages and is moved radially with respect to a shaft **205** of the plate cylinder **56** on a corresponding one of the cam surfaces **212—215** As shown in FIG 14 each of the cam surfaces **212—215** corresponds to one of the four color quadrants or segments of the plate cylinder indicated at reference numerals **73**a **—73**d

The configuration of each of the cam surfaces **212—215** is such as to enable its corresponding cam followers **206** and **207** to move radially inwardly to engage its corresponding ink rolls with its corresponding color quadrant of the plate cylinder **56** and to move its corresponding ink rolls radially outwardly away from the plate cylinder as the other color quadrants rotate therepast As a consequence the ink rolls of each of the inking systems **69—72** engage only the particular plate on the plate cylinder which corresponds to such ink rolls

Each of the cam followers **206** and **207** is provided with electric solenoid locking means for holding the cam followers and their corresponding ink rolls in a trip position out of engagement with their corresponding color quadrant of the plate cylinder **56** in the event that one or more of the colors is to be omitted. Referring to FIGS. **21** and **23**, electric solenoid locking means are indicated generally at reference numerals **220** and **221** and may be more particularly characterized as comprising respectively an electric rotary solenoid **222** mounted on the wedge plate **201** The solenoid **222** has a

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rotatable shaft 223 projecting therefrom and extending through the wedge plate 221. Fixedly connected to the distal end of shaft 223 is a pivotal arm 224 which oscillates back and forth between two pivotal positions as the solenoid 222 is energized and deenergized.

The "trip" position of the pivot arm 224 is shown in the dashed lines indicated at reference numeral 224a in FIG 21. In this position the pivot arm is aligned with a shaft 226 on which the cam follower 206 is mounted on the arm 202, thereby preventing the cam follower 206 from moving radially inwardly and preventing the ink rolls 80 and 81 from engaging their corresponding color quadrant of the plate cylinder 56.

The cam surfaces 212—215 are constructed so as to slightly raise the cam follower shafts 226 off of the pivot arm 224 of their respective electric solenoid locking means 220 and 221 As a result the rotary solenoids 222 can easily turn to pivot their respective pivot arms back to the print positions thereof as indicated at reference numeral 224 in FIG 1 with minimal power requirements. The rotary solenoids 222 are, of course, interconnected to suitable switch means in the control panel 101 (FIG 1) to operate in suitable timed relation to the rotary solenoids 157 and 178 of the blanket cylinder tripping mechanism shown in FIG. 10 and the impression cylinder tripping mechanism illustrated in FIG. 9 Consequently when it is desired to omit one or more of the four colors of the press 50 the electric rotary solenoids of the inking systems and the blanket and impression cylinder tripping mechanisms are energized and deenergized in timed relation to one another to maintain the ink rolls 80—83 of the inking systems corresponding to the omitted colors in trip positions and to maintain the blanket cylinder 57 and the impression cylinder 58 in trip positions during the required angles of rotation thereof and in proper sequence.

Each of the cam follower arms 202 and 203 is provided with a night latch to maintain its respective ink rolls out of engagement with the plate cylinder 56 during cleanup of the press Referring to FIGS. 21 and 24 the night latches which are identified at reference numerals 216 and 217, each comprise an eccentric shaft 218 journaled on plate 201 and rotatable to vary the disposition of a stud 218a extending therefrom to maintain its corresponding cam follower arm in a trip position without the necessity of energizing its respective rotary solenoid 224. One end of the shaft 218 is formed in the shape of a nut 218b to facilitate turning of the shaft with a hand tool. A spring biased pawl 219 cooperates with a series of circumferentially spaced detents 219a to facilitate indexing of the shaft 218.

As noted, the ink rolls 80—83 are in constant engagement with their corresponding vibrator rolls 84 and 86 and are frictionally driven thereby at a peripheral speed which corresponds to the peripheral speed of the plate cylinder 56. Referring to FIGS. 14, 15 and 16, a power takeoff gear 228 is mounted on a side wall 229 of the plate cylinder 56 to mesh with a pinion gear 230 keyed to a shaft 231 which is journaled for rotation on one of the wall plates 54 of the press frame 51 Also keyed to shaft 231 for joint rotation therewith is another gear 232 which meshes with a smaller gear 233 rotatably mounted on the wall plate 54.

Trained around gear 233 is a drive chain 234 which is also trained around sprockets 236 (FIG 21) mounted on the vibrator rolls 84 and 86 of each of the inking systems 69—72 Idier sprockets 237 are interposed between the vibrator rolls 84 and 86 of each of the inking systems 69—72 as shown in FIG 15, although it will be appreciated that the idler sprockets 237 of inking systems 69 and 70 are not shown in FIG 15 in order to simplify the drawing Another pair of idler sprockets 238 and 239 are mounted on the wall plate 54 adjacent gear 233, sprocket 238 being mounted on a pivotally adjustable plate 240 for maintaining desired tension in the drive chain 234.

The pitch diameters of gears 228, 230, 232 and 233 as well as the pitch diameters of the sprockets 237 are interrelated to maintain the peripheral speeds of the ink rolls 80—83 equal to the peripheral speed of the plate cylinder 56 and because of the direct driving relation between the plate cylinder 56 and the ink rolls 80—83 it will be appreciated that the speed of the ink rolls varies in direct proportion to variations in speed of the plate cylinder 56.

The vibrator rolls 84 and 86 of the inking systems 69—72 are oscillated axially by another power takeoff system driven by the plate cylinder 56. In FIG. 15 is shown gear 241 which is mounted on the wall plate 54 (FIG. 17) and which meshes with the gear 228 mounted on the plate cylinder 56. A shaft 242 which is keyed to gear 241 as shown at reference numeral 243 carries a sprocket 244 which is also keyed thereto at 246 for joint rotation with gear 241.

A second drive chain indicated generally at reference numeral 247 is trained around the sprocket 244 as well as a pair of idler sprockets 248 and 249. The drive chain 247 then extends from sprocket 249 over a pair of vibrator roll oscillator sprockets 250 and 251 which are keyed respectively to shafts 252 and 253 which are journaled for rotation on the wall plate 54 of the press frame 51

The vibrator roll oscillator sprocket 250 is interconnected with the vibrator rolls 84 and 86 of the inking systems 69 and 70, and the oscillator sprocket 251 oscillates vibrator rolls 84 and 86 of the inking systems 71 and 72 The drive arrangements of oscillator sprockets 250 and 251 are substantially identical and thus only one will be described in detail.

Referring to FIGS. 15, 18 and 20 an enlarged shaft 254 is keyed at 256 to the shaft 253 and has formed in the periphery thereof a continuous groove 257 which provides a cam surface for axially oscillating a cam follower 258 projecting therein as the shaft 254 rotates in a single direction.

The cam follower 258 is connected to an externally splined shaft 259 which is mounted for axial movement in a complementarily internally splined bushing 260 mounted on the wall plate 54. A spool member 261 is secured to one end of the splined shaft 259 and receives between a pair of spaced flanges 262 and 263 and an end portion 264 of a walking beam 266 which is mounted for pivotal movement on a pin 267 and a bracket 268 secured to the wall plate 54 of the press frame 51

Spaced on either side of the pivot pin 267 are a pair of oscillator rods 269 and 270 each of which has mounted thereon a driving spool 271 which receives a follower stud 272 projecting from the walking beam 266 The rods 269 and 270 are connected to the shafts 193 and 194 of the vibrator rolls 84 and 86, and as the walking beam 266 is pivoted in opposite directions about the pivot pin 267 the vibrator rolls 84 and 86 are oscillated axially to provide an even ink profile along the length of the ink rolls 80—83.

As shown in FIG. 22, the end of vibrator roll shaft 193 is keyed to a sleeve bearing 273 in a manner to provide relative axial movement of the shaft 193 The sleeve bearing 273 is in turn pinned at 274 to the inner race 276 of a ball bearing 277 The ball bearing 277 is mounted on the wall plate 54 of the press frame 51

INK FOUNTAIN SYSTEMS

Associated with the inking systems 69—72 are an equal number of ink fountain systems shown at reference numerals 90 in FIG. 2 As previously noted, each of the ink fountain systems 90 comprises a fountain roll 91 and a transfer roller 92 which pivots between the fountain roll and its corresponding ink drum 87

Referring to FIGS 25, 26 and 27, the fountain roll 91 of each of the ink fountain systems 90 is mounted on a shaft 278 supported on a shaft extension 279 which extends through an aperture 280 formed in an adjacent wall plate 54 of the press frame 51. An outer end of the shaft extension 279 is journaled in a bearing member 281 mounted on a support plate 282 The support plate 282 is secured in spaced relation to the wall plate 54 by means of a plurality of spacer bars 283 and 284.

A portion of the periphery of the fountain roll 91 is in open communication with an ink receptacle or fountain which is

formed in part by a fountain plate or wiper blade 286 and which houses a supply of ink for application thereof to the fountain roll 91. A series of adjustment knobs 287 are spaced along the face of the fountain plate 286 for controlling the thickness of the layer of ink or the ink profile on the fountain roll 91 as will be understood by those skilled in the art.

A fountain roll cam indicated generally at reference numeral 288 rotates in unison with the fountain roll 91 and comprises relatively rotatably movable cam portions 289 and 290 mounted respectively on the fountain roll shaft 278 and the shaft extension 279. The cam portions 289 and 290 are axially aligned and comprise respectively an outer circularly shaped cam surface 291 radially inwardly extending cam surfaces 292 Since the cam members 289 and 290 are relatively rotatable it will be appreciated that the overall effective cam surface of the cam 288 varies as the cam portions 289 and 290 are rotated relative to one another

Disposed radially with respect to the cam 288 is a cam follower 293 mounted on a cam follower bracket 294 which is in turn mounted for pivotal movement on a shaft 296. The bracket 294 is fixedly clamped to the shaft 296 for joint movement therewith by means of a threaded bolt 295 and the shaft 296 is rotatably biased to maintain the cam follower 293 in engagement with the surface of the cam 288 by means of a spring 297 bottomed on a lever arm 298 fixedly secured to the shaft 296

Also securely clamped to the shaft 296 are a pair of spaced mounting flanges 299 and 300 which journal the ends of a shaft 301 of the transfer roller 92 Thus the transfer roller 92 and the cam follower 293 pivot jointly around the shaft 296

The cam follower 293 is mounted on a shaft 301 which extends through an aperture 302 formed in an adjustment plate 303 in face-to-face contact with the bracket 294 and slidable relative thereto. The shaft 301 continues to a slot 304 formed in the bracket 294 and is held on the bracket by means of a nut or the like at 306.

Also extending through the bracket 294 and the adjustment plate 303 is an eccentric shaft 307 which comprises a stud 308 received in a cylindrical bore 309 and an eccentric member 310 housed in a bore 311 formed in the bracket 294. As the eccentric shaft 307 is rotated the adjustment plate 303 moves with respect to the bracket 294, thus moving the cam follower 293 relative to bracket 294.

In the operative position of the cam follower 293 the transfer roller 92 engages the surface of the ink drum 87 as the cam follower 293 rides on the outer surface 291 of the cam 90. As the cam follower 293 drops into a recess 309 between the adjacent inner cam surfaces 292, 292 the bracket 294 pivots in a clockwise direction as viewed in FIG 25, so that the transfer roller 92 engages the periphery of the fountain roll 91. Thus for each revolution of the fountain roll 91 the transfer roller 92 pivots back and forth into engagement with the ink drum 87 and with the fountain roll 91

The distance between the inner cam surfaces 292, 292 of the cam portions 289 and 290 determines the size of the recess 3090 therebetween as well as the angle of rotation of the fountain roll 91 during which the transfer roller 92 is in engagement therewith. This in turn determines the thickness of the ink on the ink drum 87

Accordingly, in order to vary the size of the recess 3090 the cam portions 289 and 290 are rotated by means of an adjustment shaft 3100 which extends through the tubular shaft extension 279 and which has mounted thereon an adjustment knob 3111 Thus the thickness of the ink on the ink drum 87 as well as on the ink rolls 80—83 of the inking systems 69—72 varies as a function of the indexing of the cam portions 289 and 290 of the respective cam member 288

The cam follower 293 may be adjusted on the bracket 294, however, in order to maintain the transfer roller in an inoperative position, at which it is maintained in constant engagement with the fountain roll 91, thereby precluding the transfer of ink to the ink drum 87

In order to adjust the cam follower 293 to an inoperative position the eccentric shaft 307 may be rotated by means of a rod 312 which extends through an aperture 313 formed in the wall plate 54 and which is journaled in a bearing member 314 mounted in the support plate 282. A knob 316 is mounted on the rod 312 for rotating the eccentric shaft 307 to move the cam follower 293 between the operative and inoperative positions thereof.

Generally, the cam follower 293 is adjusted to the inoperative position thereof during "cleanup" of the press during which the ink is removed from the ink rolls, the vibrator rolls, the doctor rolls and the ink drums.

The present invention also contemplates the provision of means for maintaining the transfer roller 92 in engagement with the ink drum 87 during periods when one or more of the colors of the press is being omitted, thereby precluding the transfer of ink from the pertinent fountain roll 91 to its corresponding ink drum 87 Accordingly there is provided an electric rotary solenoid 317 mounted on a fountain base plate 318 and having a pivotal arm 319 extending from a rotatable shaft 320 thereof Extending from the arm 319 at the distal end thereof is a shaft 321 which slides in a slot 322 formed in a rocker arm 323. The rocker arm 323 is mounted for pivotal movement on a stationary shaft 324 and includes a finger 326 pivotal into abutting engagement with an abutment boss 327 formed on the bracket 294

Thus as the solenoid 317 rotates in one direction the finger 326 of the rocker arm 323 engages the abutment boss 327 for preventing the bracket 294 from rotating clockwise as viewed in FIG 25 and for maintaining the transfer roller 92 in engagement with the ink drum 87 Rotation of the rotary solenoid 317 in an opposite direction moves the finger 326 out of the path of travel of the abutment boss 327, thereby enabling the bracket 24 to again pivot in a clockwise direction to move the transfer roller 92 into engagement with the fountain roll 91

Once again, in order to reduce the power requirements of the rotary solenoids 317 as the cam follower 293 rides on the outer surface 291 of the cam 288 the abutment boss 327 is moved slightly off of the finger 326, thereby enabling the rocker arm 323 to be pivoted easily as the rotary solenoid 317 is energized and deenergized This solenoid is also wired to the main control panel 101 (FIG 1) to operate in timed relation with the electric solenoids 156 and 177 of the blanket cylinder and impression cylinder tripping mechanisms during such periods as one or more of the colors of the press is being omitted

DAMPENING SYSTEMS

Referring to FIGS 1, 2 and 28—35, the dampener rolls 93 and 94 as well as the vibrator roll 96 of each of the dampening systems 76—79 are mounted on the press frame 51 similarly to the ink rolls 80—83 of each of the inking systems 69—72, whereas the fountain roll 97 and the transfer roller 98 of each of the dampening system 76—79 are mounted on a door frame 329 situated at the front open side 59 of the press frame 51. The door frame 329 is pivotally mounted at one side 330 thereof to the wall member 52 by means of a pair of hinges 331 and 332. The door frame can be locked in a closed position by means of a clamp 333 mounted on an opposite side 334 of the door frame which cooperates with a rocking flange 336 mounted on the press frame 51 The fountain rolls 97 and transfer rollers 98, therefore, can be swung away from their associated vibrator rolls 96 and dampening rolls 93 and 94 to facilitate cleaning and maintenance operation and accessibility of the vibrator and dampening rolls as well as the entire adjacent portion of the plate cylinder 56.

The door frame 329 comprises a pair of spaced vertical members 337 and 338, four mounting plates 339—342 extending between vertical member 337 and the side 330 of the frame and four other mounting plates 343—346 extending between the vertical member 338 and the other side 334 of the frame 329

The fountain roll 97 of each of the dampening systems 76—79 is journaled on a pair of spaced journal members 347 and 348 connected in fixed assembly to a horizontally aligned pair of the mounting plates 339—346. A fountain 349 for receiving a supply of water is disposed directly below the fountain roll 97 and the transfer roller 98 is mounted on a rocker arm 350 pivotally mounted on a shaft 351 which is mounted on a fixed axis between a corresponding horizontally aligned pair of base plates 339—346.

The fountain rolls 93 and 94 as well as the vibrator roll 96 of each of the dampening systems 76—79 are mounted on the press frame 51 in a manner similar to the mounting arrangement of the ink rolls 80—83 of each of the inking systems 69—72 and thus a detailed description of this mounting arrangement will not be repeated herein.

It is noted, however, that the fountain rolls 93 and 94 of each of the dampening systems 76—79 are mounted respectively on plate members connected to arms 352 and 353 pivotally mounted on a shaft 354. Rotatable cam followers 356 and 357 are mounted on the distal ends of arms 352 and 353 and engage respectively the particular one of the cam surfaces 212—215 on the plate cylinder 56 which corresponds to its respective color quadrant of the plate cylinder 56. Thus the cam followers 356 and 357 of each of the dampening systems 76—79 engage the same one of the cam surfaces 212—215 which is engaged by the cam followers 206 and 207 of the corresponding one of the inking systems 69—72.

The transfer rollers 98 are pivoted back and forth between the vibrator rolls 96 and the fountain rolls 97 by means of the rocking action of the rocker arm 350 Each of the rocker arms 350 is pivoted independently of the rocker arms of the other dampening systems.

Associated with each of the rocker arms 350 is a cam follower arm 358 mounted for slidable movement in an axial direction on a pair of bearing members 359 and 360. A cam follower 361 is mounted at the radially inner end of each of the cam follower arms 358 and engages that one of the cam surfaces 212—215 of the plate cylinder 56 that is engaged by its corresponding fountain roll cam follower 356 and 357 Each of the cam followers 361 is biased into engagement with its corresponding cam surface by means of a spring 362. A radially outer end 363 of each of the cam follower arms 358 abuts its corresponding rocker arm 350 and another spring 363 (FIG. 29) is associated with each of the rocker arms 350 to maintain a pivotal bias thereof into engagement with the end 363 of the cam follower arm 358

It will thus be appreciated that each of the transfer rollers 98 of the dampening systems 76—79 moves back and forth between its corresponding vibrator roll 96 and fountain roll 97 once for each revolution of the plate cylinder 56, and that the angle of rotation of the plate cylinder 56 during which each of the cam followers 98 engages its corresponding vibrator roll 96 and fountain roll 97 is constant regardless of the speed of the plate cylinder 56.

Unlike the application of ink to the ink rolls, the optimum amount of water applied to the dampener rolls varies with the speed of the plate cylinder 56 This is as a result of the very thin layer of water which is applied to the plates of the plate cylinder as well as to the variation in the rate of evaporation of water as contrasted with ink

For any given speed of rotation of the plate cylinder 56 an optimum amount of water is transferred from the fountain roll 97 to the vibrator roll 96 of each of the dampening systems 76—79 As the speed of rotation of the plate cylinder 56 increases a greater amount of water should be transferred to the vibrator rolls 96 per revolution of the plate cylinder but this increase in water should not be in direct proportion to the increase of the speed of the plate cylinder This is because the amount of water evaporated from the vibrator rolls 96 during one revolution of the plate cylinder 56 decreases as the speed of the plate cylinder increases

It is known in the prior art to vary the amount of water applied to the vibrator roll per unit of time as a function of variations in plate cylinder speed. Generally this has been accomplished by varying the number of degrees of the angle of rotation of the plate cylinder during each revolution of the plate cylinder during which the transfer roller is in contact with the fountain roll. Most prior art arrangements accomplish such compensation by employing an adjustable cam and cam follower arrangement which is manually adjusted in accordance with changes in speed of the plate cylinder.

The present invention contemplates the provision of means for such nonlinear compensation without varying the degrees of angle of rotation of the plate cylinder during which the transfer rollers are in engagement with their corresponding fountain rolls. Instead, while the speed of the vibrator rolls 96 and the dampener rolls 93 and 94 varies in direct proportion to variations in the speed of the plate cylinder, the speed of the fountain rolls 97 varies nonlinearly with respect to changes in plate cylinder speed.

Referring to FIG. 15, the drive chain 247 which effectively oscillates the vibrator rolls of the inking systems 69—72 also serves to rotate the ink fountain rolls 91 at a speed directly proportional to the speed of the plate cylinder 56. Thus each of the sprocket-turned shafts 252 and 253 has mounted thereon for joint rotation a gear 363 which engages a worm 364 formed on a rotatable shaft 366 Two other worms 367 and 368 are also formed on shafts 366 to turn gears 369 and 370 mounted respectively on the shafts of the fountain rolls 91, 91 As a consequence, the ink fountain rolls 91 are always rotated at a speed which varies directly with variations in the speed of the plate cylinder 56

The vibrator rolls 84 and 86 of the dampening systems 76—79 are also driven at a speed which varies directly with variations in plate cylinder speed. Note that driven chain 234 (FIG 15) is trained around sprockets 371 mounted for joint rotation on the shafts of the vibrator rolls 84 and 86

The fountain rolls 97, however, of the dampening systems 76—79 are rotated respectively by means of individual variable speed electric motors 372—374 mounted on the plates 339—342 of the door frame 329 The motors 372—374 are connected to their corresponding fountain rolls 97 through gear boxes indicated at reference numerals 376

The schematic shown in FIG 36 illustrates means for varying the speed fountain rolls of the dampener systems nonlinearly with respect to variations in plate cylinder speed The plate cylinder is indicated diagrammatically at reference character 56*a* and one of the dampener system fountain rolls is indicated at 97*a* Reference character 61*a* indicates the variable speed motor which drives the plate cylinder 56*a* and reference character 372*a* indicates one of the variable speed motors of the dampener systems 76—79.

A pair of speed controls 376 and 377 are connected respectively to motors 61*a* and 372*a* and are interconnected to provide a variable proportionality factor between the speeds of the motors as the speed of the motor 61*a* is varied by means of a controller or the like at 378. Such nonlinear speed controls are known in the art and thus need not be described in greater detail It will be apparent that this arrangement provides automatic speed compensation between the speed of the plate cylinder 56 and the speed of the dampener system fountain rolls 97

Referring to FIG. 31, one end of each of the vibrator rolls 96 of the dampening systems 76—79 is journaled for axial oscillating movement in one of the wall plates 54 as indicated at reference numerals 379 and 380. Extending from the wall plate 54 is a bifurcated member 381 mounting a pair of oppositely facing rollers 382 and 383 which project into helical grooves 384 formed in collars 386 connected in fixed assembly to the shafts of the vibrator rolls 96, 96. Thus as the vibrator rolls are rotated they are oscillated axially by the camming action of the rollers 382 and 383 against the walls of the helical grooves 384.

I claim:

1 A multicolor rotary offset printing press comprising.

A plate cylinder having a plurality of circumferentially spaced color segments therearound;

a blanket cylinder in nip-defining relationship with said plate cylinder and having a plurality of circumferentially spaced color segments therearound corresponding respectively to the color segments of said plate cylinder;

an impression cylinder in nip-defining relationship with said blanket cylinder;

variable speed drive means for rotating said cylinders jointly;

speed control means connected to said plate cylinder drive means for varying the speed of said plate cylinder, means for supporting and tripping said blanket cylinder out of engagement with said plate cylinder to a trip position and then back into engagement therewith to a print position as each pair of corresponding color segments is rotated into the nip between said plate and said blanket cylinders;

means for holding said blanket cylinder in the trip position thereof as any preselected pair of said corresponding color segments rotates through the nip between said plate and blanket cylinders;

means for supporting and tripping said impression cylinder out of engagement with said blanket cylinder to a trip position and then back into engagement therewith to a print position as each of said color segments of said blanket cylinder is rotated into the nip between said impression and said blanket cylinders,

means for holding said impression cylinder in the trip position thereof as any preselected color segment of said blanket cylinder rotates through the nip between said impression and said blanket cylinders,

a plurality of inking systems corresponding in number to the number of color segments arranged around a portion of the periphery of said plate cylinder, each of said inking systems comprising an ink roll movable into and out of engagement with said plate cylinder and means for moving said ink roll into engagement only with its corresponding color segment on said plate cylinder during rotation thereof; and

a plurality of dampening systems arranged around another portion of the periphery of said plate cylinder, each of said dampening systems comprising a dampener roll, a vibrator roll, a fountain roll and a transfer roller pivotal back and forth between said vibrator and said fountain roll, means for rotating said vibrator and dampener rolls at a peripheral speed corresponding to the peripheral speed of said plate cylinder, means operatively interconnecting said transfer roller and said plate cylinder for pivoting the transfer roller alternately into engagement with said fountain roll and said dampener roll during preselected angles of rotation of said plate cylinder, variable speed drive means for rotating said fountain roll, and speed control means connected to said fountain roll drive means and to said plate cylinder drive means to drive said fountain roll at a speed which varies nonlinearly as a function of variations in the speed of the plate cylinder

2 The printing press as defined in claim 1 wherein said means for holding said blanket cylinder and said impression cylinder in the trip positions thereof comprise, a pair of independently operable electric solenoid means engageable with said blanket cylinder and said impression cylinder supporting and tripping means, respectively.

3. The printing press as defined in claim 1 and including, a plurality of circumferential cam surfaces on said plate cylinder corresponding respectively to each of said color segments; said transfer roller pivoting means of said dampening systems comprising respectively cam follower means engageable with only one of said cam surfaces for driving relation therebetween

4 The printing press as defined in claim 1 and including, a plurality of circumferential cam surfaces on said plate cylinder corresponding respectively to each of said color segments, said ink roll moving means of said inking systems comprising respectively cam follower means engageable with only one of said cam surfaces for driving relation therebetween

5. The printing press as defined in claim 1 and including, a press frame, and door means pivotally mounted on said frame adjacent said another portion of said plate cylinder for swingable movement therefrom, said fountain roll, said transfer roller and said fountain roll variable speed drive means of each of said dampening systems being mounted on said door means and said dampener rolls and said vibrator rolls being mounted on said frame.

6. A multicolor offset printing press comprising a press frame; a plate cylinder having a plurality of circumferentially spaced color segments therearound mounted on said frame; a blanket cylinder in nip-defining relationship with said plate cylinder and having a plurality of circumferentially spaced color segments therearound corresponding respectively to the color segments on said plate cylinder; an impression cylinder in nip-defining relationship with said blanket cylinder; a plurality of inking systems on said frame corresponding in number to the number of color segments arranged around a portion of the periphery of said plate cylinder, each inking system having means for inking only a selected color segment on said plate cylinder during rotation thereof; means for rotating said plate cylinder at a speed which corresponds to the speed of said blanket cylinder, means for journaling said blanket cylinder on said frame for movement between first and second positions at which said blanket cylinder is moved into and out of printing engagement with said plate cylinder, and means for selectively and repeatedly tripping one or more of the said color segments on said blanket cylinder into and out of printing engagement with one or more of the color segments on said plate cylinder which correspond thereto while said press is operating at its normal operating speed to thus enable printing from any one or any combination of the said plurality of plates.

7 A multicolor rotary offset printing press as defined in claim 6 wherein an eccentric shaft is rotatably mounted on said frame; said impression cylinder being mounted on said eccentric shaft for relative rotation therewith, and means for selectively rotating said eccentric shaft in opposite directions to selectively and repeatedly move said impression cylinder between a print position and a trip position relative to one or more of the color segments on said blanket cylinder as a function of the angular disposition of said blanket cylinder as it rotates at its normal operating speed

8 The printing press as defined in claim 7 wherein said eccentric shaft rotating means comprises, a plurality of cam members mounted on said blanket cylinder for rotation therewith, and means including cam follower means disposed in the path of travel of said cam members and operatively connected to said eccentric shaft for rotation thereof as each of the cam members engages said cam follower means

9 A multicolor rotary offset printing press as defined in claim 6 wherein said plate cylinder, blanket cylinder and impression cylinder are situated on spaced parallel axes with said plate cylinder being mounted on said frame for rotation on a fixed axis; means for journaling said impression cylinder, said blanket cylinder tripping means and an impression cylinder tripping means mounting said blanket cylinder journaling means and said impression cylinder journaling means on said frame, each of said tripping means being selectively and repeatedly movable between two positions for moving respectively said blanket cylinder between a print position and a trip position with respect to said plate cylinder and said impression cylinder between a print position and a trip position with respect to said blanket cylinder, driving means for jointly rotating said cylinders; and means driven by said driving means and operative to selectively and repeatedly move said tripping means respectively between said two positions thereof as a function of the radially angular disposition of said blanket cylinder upon rotation thereof at normal operating speeds.

10. The printing press as defined in claim 9 wherein each of said tripping means comprises an eccentric shaft mounted on said frame and said last named means comprises cooperating

cam members and cam follower means mounted respectively on one of said cylinders and on said tripping means for rotating said eccentric shafts in response to rotation of said one cylinder.

11. The printing press as defined in claim 9 and including, first and second electrically operated means mounted on said frame and engageable with said last named means for selectively independently locking said last named means in the print positions thereof.

12. The printing press as defined in claim 11 wherein said electrically operated means comprises electric solenoid means.

13. The printing press as defined in claim 11 wherein said electrically operated means comprises electric rotary solenoid means.

14. The printing press as defined in claim 6 wherein said means for journaling comprises:

bearing means at the ends of said blanket cylinder

guide means mounting said bearing means on said frame for guiding said bearing means between said first and second positions;

means biasing said bearing means towards said second position; and

means operatively interconnecting said blanket cylinder and said bearing means for moving said bearing means to said first position as a function of the angular disposition of said blanket cylinder as it rotates

15. The printing press as defined in claim 14 wherein said bearing moving means comprises·

plural cam members spaced angularly about the axis of and mounted on said blanket cylinder, and

cam follower means located in the path of travel of said cam members for engagement therewith as said blanket cylinder rotates and operatively connected to said bearing means for moving said bearing means to said first position as said cam members respectively engage said cam follower means.

16 The printing press as defined in claim 14 wherein said bearing means comprises an elongated lever arm and said guide means comprises a pin pivoting said lever arm to said frame at one end of the arm

17 The printing press as defined in claim 16 wherein said biasing means and said bearing moving means operatively engage said lever arm at the opposite end of the arm.

18. The printing press as defined in claim 17 wherein said bearing moving means comprises:

a trip block movable in one direction against said lever arm to move said blanket cylinder into printing engagement with said plate cylinder and movable in an opposite direction away from said lever arm to enable said blanket cylinder to move out of printing engagement with said plate cylinder;

an eccentric shaft mounted on said frame; and

means interconnecting said trip block and said eccentric shaft for moving said trip block in said opposite directions in response to rotation of said eccentric shaft in opposite directions, and means operatively interconnecting said eccentric shaft and said blanket cylinder for rotating said shaft in said opposite directions of rotation as a function of rotation of said blanket cylinder

19 The printing press as defined in claim 18 wherein said eccentric shaft rotating means comprises spring means for biasing said shaft in one of said opposite directions of rotation to move said trip blocks away from said lever arm

20. The printing press as defined in claim 18 wherein said eccentric shaft rotating means comprises

a plurality of cam members on said blanket cylinder in radially angularly spaced relation with one another, and

a cam follower in the path of travel of said cam members and operatively connected to said eccentric shaft to be engaged and moved in one direction by each of said cam members as said blanket cylinder rotates to effect movement of said blanket cylinder to a print position thereof. and means biasing said cam follower in an opposite direction to effect movement of said blanket cylinder to a trip position thereof

21 The printing press as defined in claim 20 and including, means for selectively locking said cam follower against movement in said opposite direction to maintain said blanket cylinder in the print position thereof

22 The printing press as defined in claim 21 wherein said locking means comprises. an abutment wall formed on said cam follower, and an electric solenoid mounted on said frame and having a member movable into and out of engagement with said abutment wall upon energization and deenergization thereof

9

United States Patent

[11] **3,604,350**

[72] Inventor **Lawrence Rosenstadt** Rye, N.Y.

[21] Appl. No. 818,647

[22] Filed Apr. 23, 1969

[45] Patented Sept. 14, 1971

[73] Assignee Lee Machinery Corporation New York, N.Y.

[54] **FLEXOGRAPHIC PRESSES WITH INTERRUPTER AND CYLINDER REGISTER MECHANISMS**
8 Claims, 7 Drawing Figs.

[52] U.S. Cl. 101/181, 101/182, 101/247, 101/248, 101/351

[51] Int. Cl. B41f 5/16, B41f 31/30

[50] Field of Search 101/181, 182, 184, 185, 247, 248, 209, 351, 352, 206, 207; 74/31

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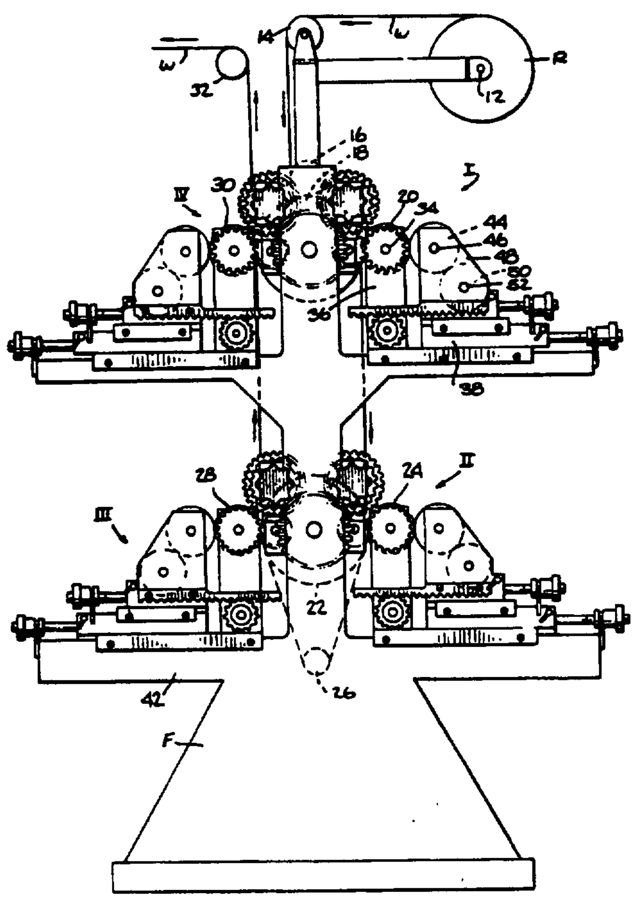
ABSTRACT: A flexographic press having a plurality of printing stations with each station having an associated impression cylinder, a printing plate cylinder mounted for individual movement back and forth relative to its impression cylinder, and an ink fountain roller mounted for individual movement back and forth relative to its printing plate cylinder, and means for correcting the web registration between stations.



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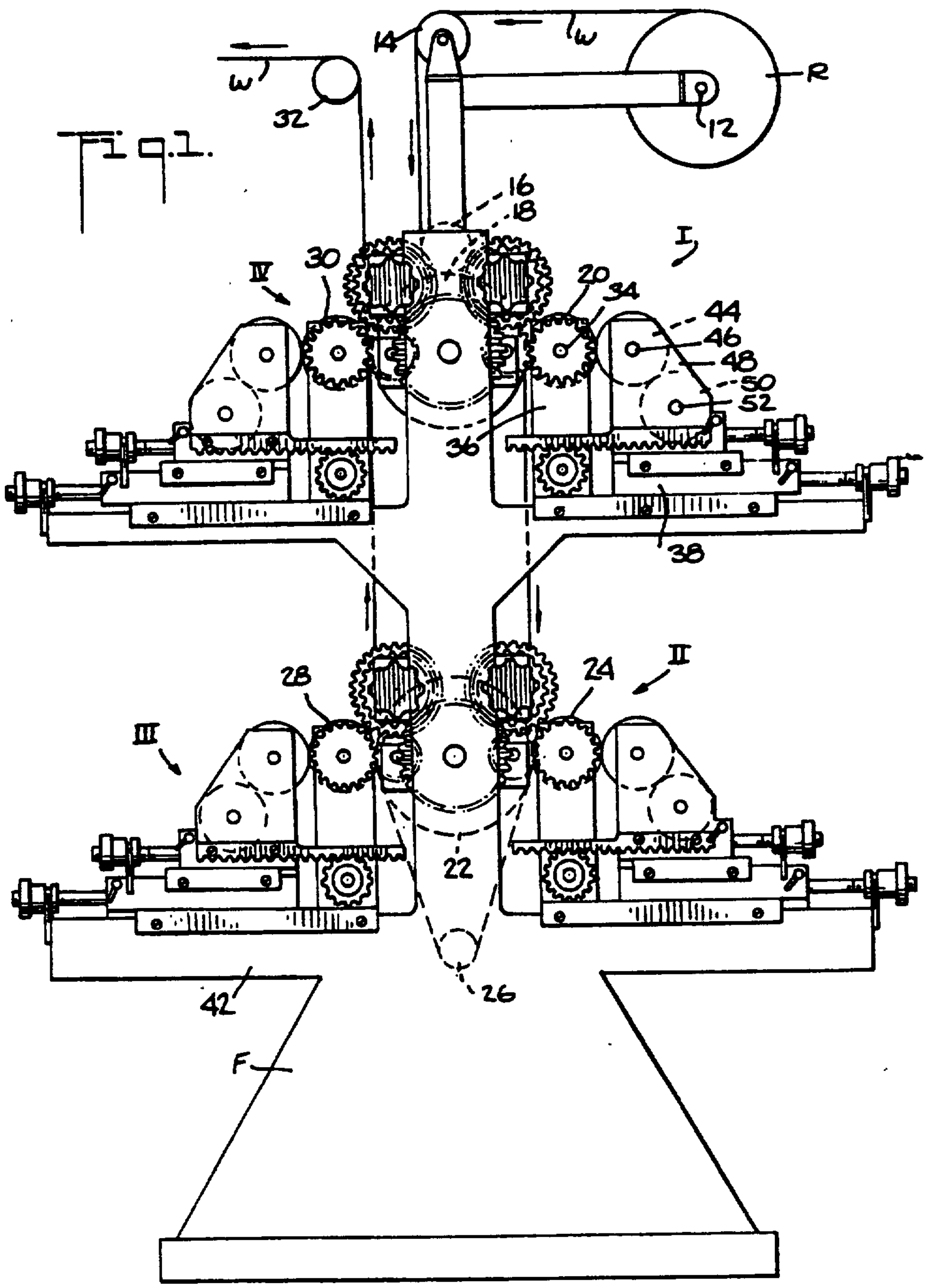

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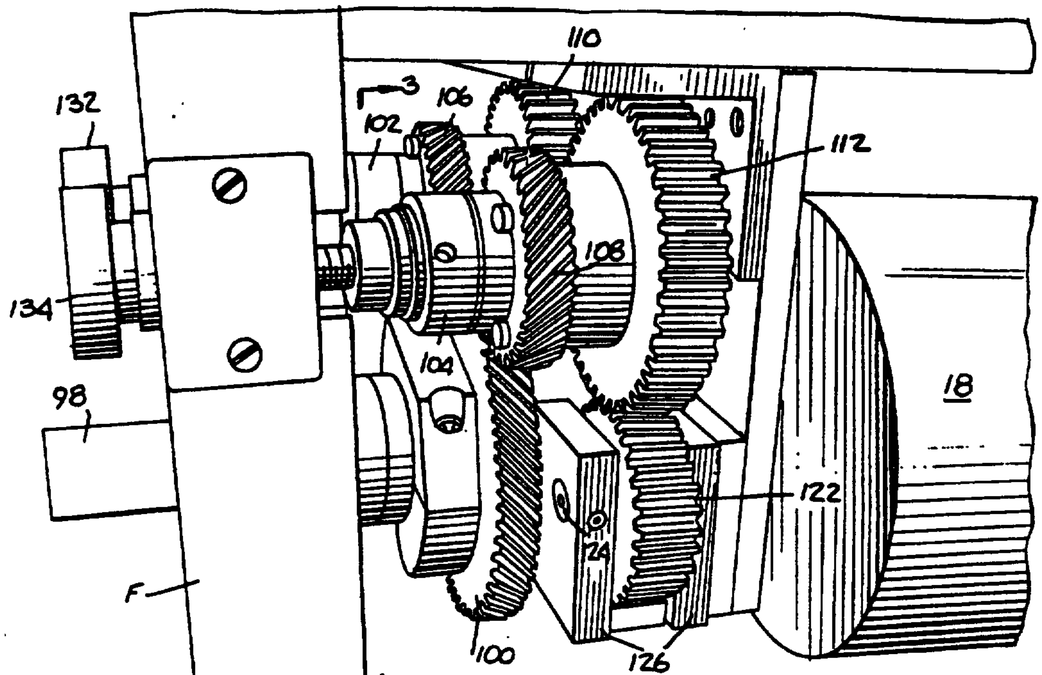

Fig. 2.

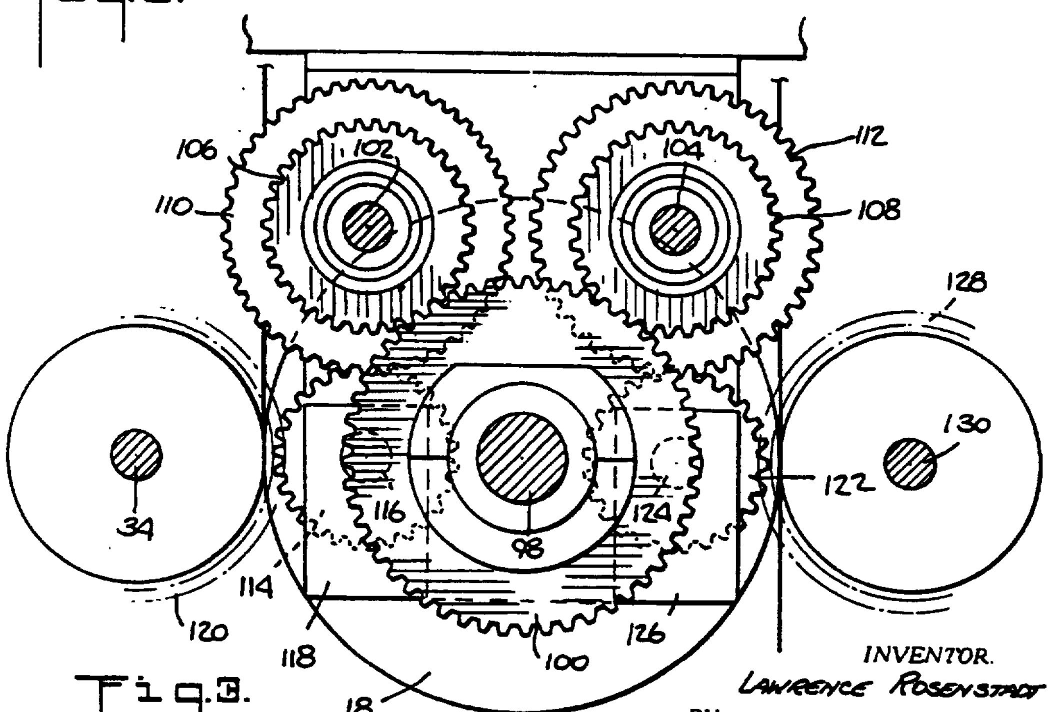

Fig. 3.

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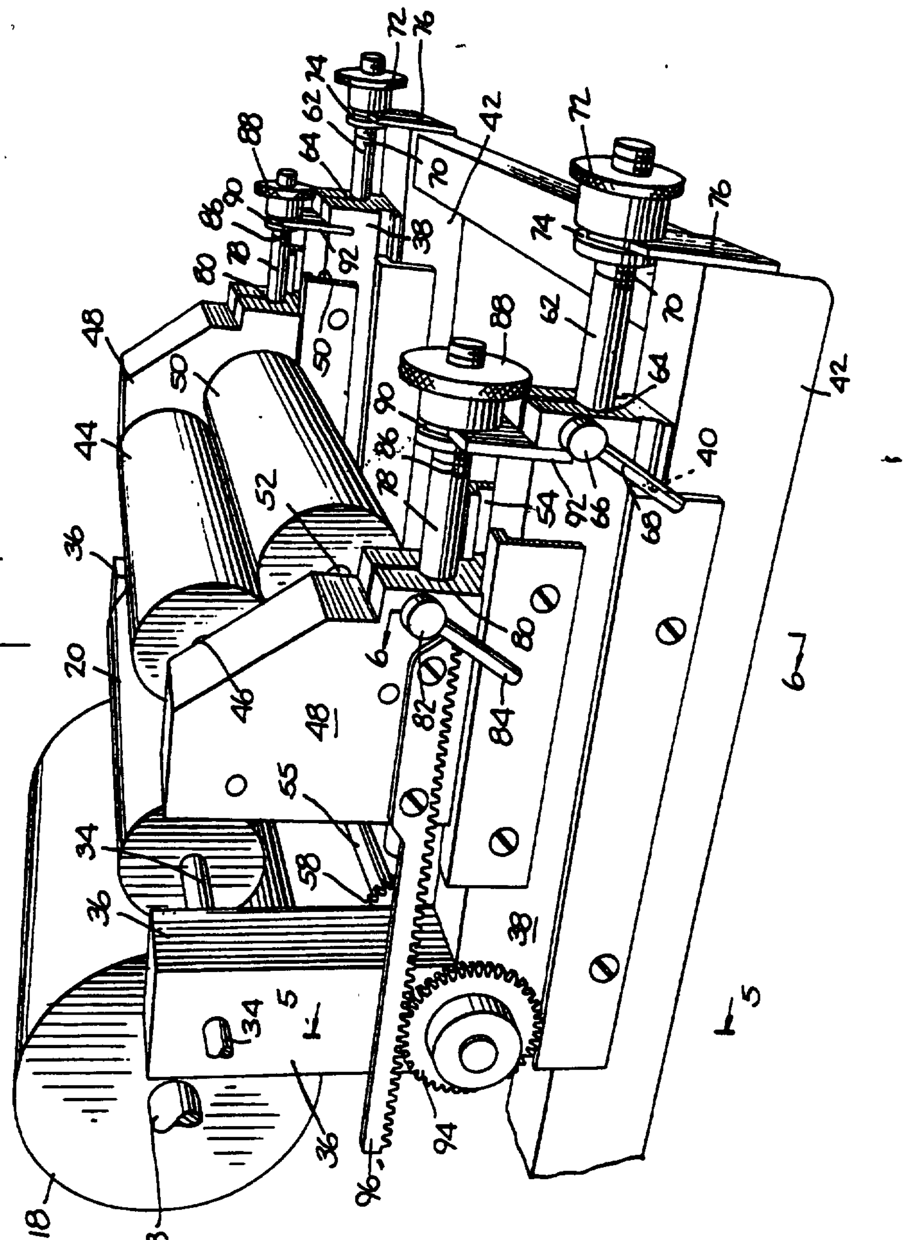

Fig. 4.

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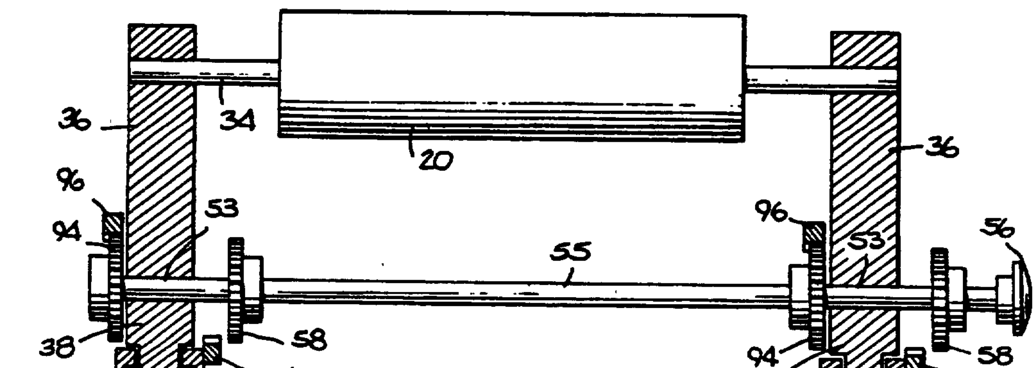

Fig.5.

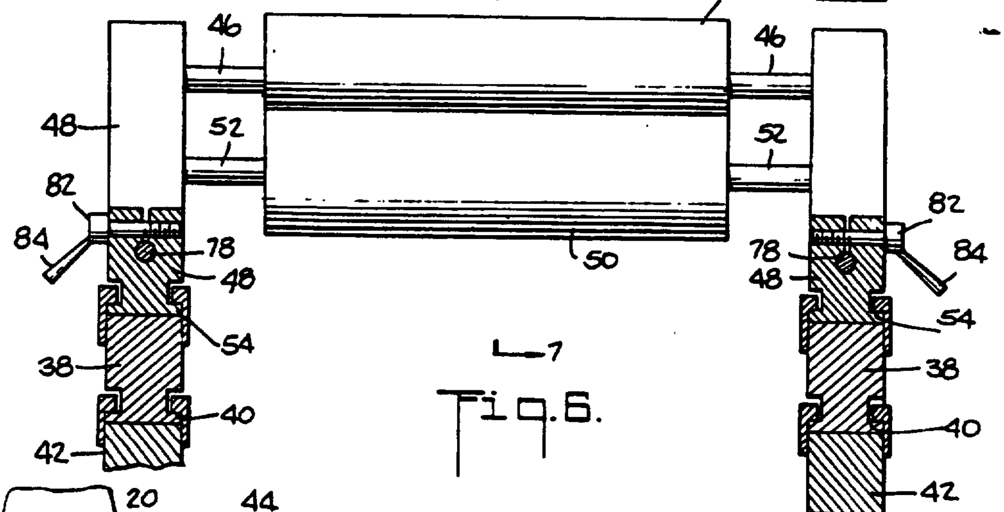

Fig.6.

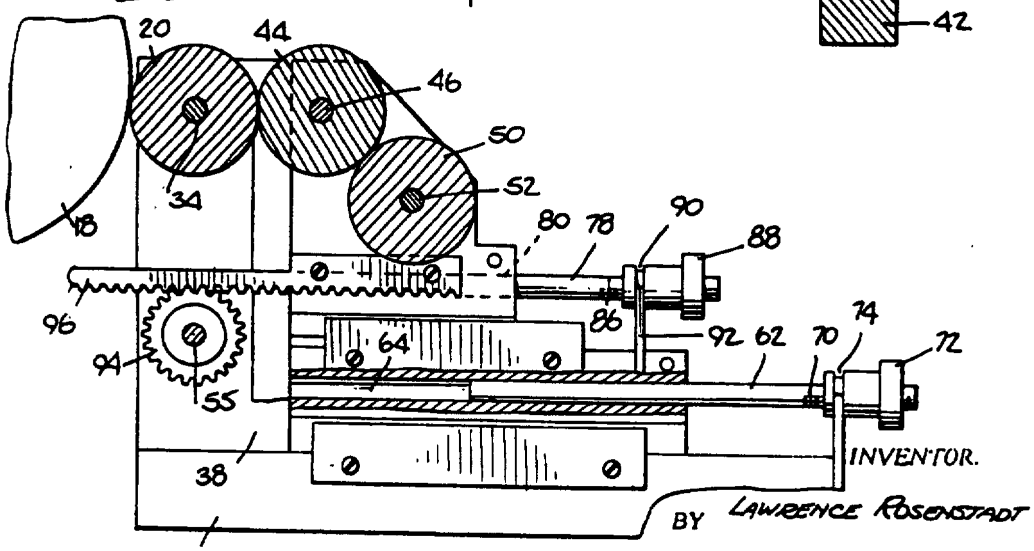

Fig.7.

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FLEXOGRAPHIC PRESSES WITH INTERRUPTER AND CYLINDER REGISTER MECHANISMS

This invention relates to printing presses and more particularly to flexographic presses.

The type of printing known as flexography or aniline printing is a specialized form of relief printing used for printing on such materials as cellophane, polyethylene, or the like. This type of printing is generally characterized by the use of flexible rubber plates carried by the printing cylinders of web-fed rotary presses. Generally, the plates are inked by a single inking roller and the material to be printed is fed between the press plate cylinder and its associated impression cylinder.

It is usual for this type of flexographic press to print multiple colors with a plate cylinder, and a coacting impression cylinder associated with each particular color to be printed. Precise registration of the web between successive printing stations in a press of this nature is critical. Prior art means for controlling this registration is disclosed in U.S. Pat. No. 3,233,539 dated Feb. 8, 1966. The present invention concerns improvements upon the features of such apparatus.

Conventionally, flexographic presses of the class described include means for laterally moving the printing plate cylinder with respect to the impression cylinder as well as means for laterally moving the ink plate roller with respect to the printing plate cylinder. Prior art means for effecting such movements are disclosed in aforementioned Pat. No. 3,233,539. This invention is directed to improvements upon the features of the apparatus of the prior art.

Briefly my invention contemplates the provision of a flexographic press having a plurality of printing stations with each station having an ink fountain roller, a printing plate cylinder and a related impression cylinder. It will be understood that more than one printing plate cylinder may be associated with each impression cylinder and in the flexographic printing press illustrated, two such printing plate cylinders are normally associated with each impression cylinder. In each station, means are provided for mounting the printing plate cylinders for individual movement back and forth relative to its impression cylinder and means are provided for mounting each of the ink fountain rollers for individual movement back and forth relative to its printing plate cylinder. In addition, means are provided for correcting the web registration between stations.

In one form of my invention the means for mounting the printing plate cylinder include a printing plate cylinder shaft carrying the printing plate cylinder and a printing plate cylinder frame having upward extensions for carrying the printing plate cylinder. The press is provided with a crossarm having a keyway therein for slidably receiving the printing plate cylinder frame thereon. In addition, means are incorporated for providing course adjustments as well as vernier adjustments of the printing plate cylinder frame with respect to the impression cylinder, thereby insuring effective and rapid adjustment of the printing plate cylinder.

In another form of my invention, I provide means for mounting an ink fountain roller including an ink fountain roller shaft which carries the roller and which, in turn, is mounted on an ink fountain carriage. The printing cylinder frame is provided with a keyway for slidably receiving the carriage. Means are incorporated for providing course adjustments and vernier adjustments of the ink fountain carriages with respect to the printing cylinder frame, thereby insuring effective and rapid adjustment of the ink fountain roller.

In still another form of my invention, I provide means for adjusting the rotational position of the printing plate cylinder with respect to the impression cylinder to correct the web registration between stations, which include a pair of mating helical gears, one of said gears being in direct drive relationship with respect to the printing plate cylinder and the other of said helical gears being in direct drive relationship with respect to the impression cylinder. Means are incorporated for adjusting the relative position between the pair of helical gears to provide partial rotational movement of the printing plate cylinder with respect to the impression cylinder.

There has been outlined rather broadly the more important features of the invention in order that the detailed description thereof that follows may be better understood, and in order that the present contribution to the prior art may be better appreciated. There are, of course, additional features of the invention that will be described hereinafter which will form the subject of the claims appended hereto. Those skilled in the art will appreciate that the conception on which this disclosure is based may readily be utilized as the basis for the design of other structures for carrying out the several purposes of the invention. It is important, therefore, that this disclosure be regarded as including such equivalent constructions as do not depart from the spirit and scope of the invention.

One embodiment of the invention has been chosen for purposes of illustration and description, and is shown in the accompanying drawings, forming a part of this specification, wherein:

FIG. 1 is a detailed side elevation, partly in section, of a flexographic press constructed according to the concept of my invention;

FIG. 2 is an enlarged perspective view showing the gear means for effecting registration of the web between successive printing stations in the press;

FIG. 3 is an enlarged side elevation, taken along the line indicated at 3—3 in FIG. 2;

FIG. 4 is a perspective view of the flexographic press showing the means for effecting movement of the printing plate cylinder with respect to the impression cylinder and movement of the ink fountain roller with respect to the printing plate cylinder;

FIG. 5 is an enlarged vertical sectional view taken along the line indicated at 5—5 in FIG. 4, and showing details of the means for moving the printing plate cylinder with respect to the impression cylinder;

FIG. 6 is an enlarged vertical section view taken along the line indicated at 6—6 in FIG. 4, and showing details of the means for moving the ink plate roller with respect to the printing plate cylinder; and

FIG. 7 is a vertical sectional view taken along the line indicated at 7—7 in FIG. 6.

Referring to the drawings in greater detail, as shown in FIG. 1, a four-color flexographic press embodies a main frame F carrying a supply roll R rotatably mounted on a shaft 12. It will be understood that supply roll R can also be rotatably mounted on a separate unwinding stand with equal facility. Web material is fed from the supply roll around the idler roll 14 and then around draw roll 16, preferably fabricated from rubber or other similar material. From the draw roll 16, the web passes an upper impression cylinder 18 and a first printing plate cylinder 20 at a first printing station, indicated generally at I. Next, the web is fed between a lower impression cylinder 22 and a second printing plate cylinder 24 at a second printing station indicated generally at II, and then the web is fed over a bottom roller 26. Thereafter, the web passes between the lower impression cylinder 22 and a third plate printing plate cylinder 28 at a third printing station indicated generally at III, and then the web passes between the upper impression cylinder 18 and a fourth printing plate cylinder 30 at a fourth printing station indicated generally at IV. Thence, the web is led around idler roller 32 and through a heated drying tunnel to a rewind roll (not shown). In normal operation, the web passes successively through the printing stations I, II, III and IV, and at each printing station a separate color is imprinted thereon by printing plate cylinders 20, 24, 28 and 30, respectively. Frequently, heating means (not shown) are interposed between successively printing stations to hasten the drying and setting of the ink. The web W is drawn from the roll R by the coaction of the impression cylinder 18 and the draw roll 16 which are driven by any suitable source, known in the art. In addition, suitable draw rollers (not shown) on the rewind side of the press may assist in pulling web W through the press.

As best seen in FIGS. 1 and 4, the printing cylinder 20 is mounted on a printing plate cylinder shaft 34 which is supported at each end by upward extensions 36 of printing plate cylinder frame 38. This frame, in turn, is slidably mounted in suitable keyways 40 formed in crossarms 42 of the press frame F. An engraved ink roller 44 associated with the printing plate cylinder 20 is mounted on an ink roller shaft 46 which is carried at each end by an ink system carriage 48. An ink fountain roller 50, mounted on ink fountain roller shaft 52 is also carried at each end by the ink carriage 48. The carriage 48 is slidably mounted in a suitable keyway 54 formed in the printing cylinder frame 38.

On each side of the press, the plate cylinder frame 38 is arranged for controlled travel along the crossarm 42 by a coarse adjusting means and by a fine or vernier adjusting means. Referring in particular to FIG. 4, the fine or vernier adjusting means for the plate cylinder frame comprises a frame adjusting shaft 62 mounted in a bore 64 in the plate cylinder frame 38 for longitudinal motion. This shaft may be locked in any desired longitudinal position by means of a releasable locking screw 66, the locking screw being provided with a handle 68 to simplify its manual manipulation. The other end of the shaft 62 is threaded, as at 70, and a hand manipulatable frame adjusting nut 72 is mounted thereon. This nut is provided with a circumferential groove 74 for receiving a bracket 76 fixedly mounted on the crossarm 42, so that rotation of the nut 72 causes the shaft 62 to move longitudinally with respect to the crossarm 42, thereby causing the plate cylinder frame 38 to move longitudinally with respect to the crossarm 42, providing a fine or vernier adjustment of the plate cylinder frame.

As best seen in FIG. 5, the coarse adjusting means for the travel of the cylinder frame 38 along the crossarm 42 comprises a gear shaft 55 mounted on the crossarm 42, as at 53. A knob 56 is mounted on one end of the gear shaft for purposes of manual manipulation by the operator, and a pair of gears 58, one on each side of the machine, is mounted on the shaft. An elongated rack 60 is mounted on the crossarm 42 on each side of the machine, and the gear shaft is arranged for transverse motion with respect to the press so that when the shaft is moved to the right as viewed in FIG. 5, the gears 58 are in their disengaged positions with respect to racks 60 and when the shaft is moved to the left as viewed in FIG. 5, the gears 58 engage the racks 60. It will be appreciated that when the gear 58 are in their engaged positions, and the releasable lock screws 66 (FIG. 4) are in their released positions, manipulation of the knob 56 in one direction will cause forward motion of the plate cylinder frame 38 with respect to the crossarm 42 and manipulation of the knob in the opposite direction will cause backward motion of the plate cylinder frame with respect to the crossarm. Normally, in operation, after the coarse adjustment has been completed, the lock screws 66 are moved to their locked positions; and then the nuts 72 of the vernier adjusting means are manipulated to complete the fine adjustment of the plate cylinder frame with respect to the crossarm.

On each side of the press, the ink fountain carriage 48 is arranged for controlled travel along the printing cylinder frame 38 by a coarse adjusting means and by a fine or vernier adjusting means. As best seen in FIG. 4, the fine or vernier adjusting means for the ink fountain carriage 48 comprises a carriage adjusting shaft 78 mounted in a bore 80 in the ink fountain carriage for longitudinal motion. This shaft may be locked in any desirable longitudinal position by means of a releasable locking screw 82, the locking screw 82 being provided with a handle 84 to simplify its manual manipulation. The other end of the carriage adjusting shaft 78 is threaded, as at 86, and a hand manipulatable carriage adjusting nut 88 is mounted thereon. This nut is provided with a circumferential groove 90 for receiving a bracket 92 fixedly mounted on the printing cylinder frame 38 so that rotation of the carriage adjusting nut 88 causes the shaft 78 to move longitudinally with respect to the printing cylinder frame 38, thereby causing the ink fountain carriage 48 to move longitudinally with respect to the printing cylinder frame 38, providing a fine or vernier adjustment of the ink fountain carriage.

As best seen in FIGS. 4 and 5, the coarse adjusting means comprises a pair of gears 94, one on each side of the machine, mounted on the gear shaft 55. An elongated rack 96 is mounted on the ink carriage 48 on each side of the machine and the shaft 55 is arranged for transverse motion with respect to the press so that when the shaft is moved to the left, as viewed in FIG. 5, the gears 94 are in their disengaged positions with respect to the racks 96, and when the shaft is moved to the right as viewed in FIG. 5, the gears 94 engage the racks 96. It will be appreciated that when the gears 94 are in their engaged positions, and the releasable lock screws 82 are in their released positions, manipulation of the knob 88 in one direction will cause forward motion of the ink fountain carriage 48 with respect to the plate cylinder frame 38 and manipulation of the knob in the other direction will cause backward motion of the carriage 48 with respect to the frame 38. Normally, in operation, after the coarse adjustment has been completed, the lock screws 82 are moved to their locked positions, and then the nuts 88 of the vernier adjusting means are manipulated to complete the final adjustment of the ink fountain carriage 48 with respect to the plate cylinder frame 38.

As the web W travels between printing stations I, II, III and IV, the speed thereof may vary slightly or the components may not be exactly lined up, thereby resulting in successive printing images of the web that do not register one with the others. Means are provided for correcting the web registration between stations which are incorporated with the main driving mechanism of the press. As best seen in FIGS. 1, 2 and 3, power is supplied to the press from any suitable source through a main shaft 98 mounted for rotation on the frame F. This shaft carries the impression cylinder 18. Also, mounted on the shaft 98 is a helical gear 100. In addition, mounted for rotation on the frame F is a pair of shafts 102, 104 which also carry helical gears 106 and 108, respectively. Both of these gears are mounted and arranged in mating relationship with gear 100. In addition, mounted on shafts 102 and 104 are gears 110 and 112, respectively. Gear 110 drives a gear 114 which is mounted for rotation on shaft 116 carried by bracket 118 mounted on the frame F. A gear 120 driven by gear 114 is mounted on the shaft 34 which also carriage the printing plate cylinder 20. On the other side of the machine, in printing station I, the gear 112 drives gear 122 which is mounted on shaft 124 carried by bracket 126 mounted on the frame F. A gear 128 which is mounted on the shaft 130, carries the printing plate cylinder 30. Accordingly, in operation, rotation of the main drive shaft 98 causes rotation of the impression cylinder 18 as well as of the printing plate cylinders 20 and 30. Shafts 102 and 104 have hand knob 132 and 134, respectively, fixedly attached thereto. It will be understood that manual rotation of knob 132 will cause longitudinal motion of shaft 102 which, in turn, causes rotation of gear 110 relative to gear 100 due to the helical design of gear 106. In this manner, the impression cylinder 118 will remain rotationally fixed while the printing plate cylinder 20 rotates slightly, thereby correcting any registration misalignment. In like manner, manual manipulation of knob 134 serves to cause slight rotation of gear 112 and hence printing plate cylinder 30 with respect to gear 100 and impression cylinder 18.

It will be appreciated that the printing plate cylinders 24 and 28 are arranged and driven with respect to the impression cylinder 22 to provide for the same registration adjustment just described in connection with the printing plate cylinders 20 and 30 with respect to the impression cylinder 18.

It will thus be seen that the present invention does indeed provide a new and improved flexographic press which is superior in simplicity, economy, and efficiency as compared to prior art such devices.

Although a particular embodiment of the invention is herein disclosed for purposes of explanation, various modifications thereof, after study of this specification, will be apparent to those skilled in the art to which the invention pertains.

What is claimed and desired to be secured by Letters Patent is:

1. In a flexographic press having a plurality of printing stations with each station having an ink fountain roller, a printing plate cylinder and a related impression cylinder, the combination in each station comprising means mounting said printing plate cylinders including a printing plate cylinder shaft, said printing plate cylinder being mounted on said printing plate cylinder shaft, a printing plate cylinder frame having upward extensions, said printing plate cylinder shaft being mounted on said extensions, a press frame having a crossarm, said crossarm having a printing plate cylinder frame keyway, said printing plate cylinder frame being slidably mounted on said cylinder frame keyway, a gear shaft, means for manually rotating said gear shaft, a gear mounted on said gear shaft, an elongated rack mounted on said crossarm, said gear shaft being arranged for transverse motion with respect to said press to engage and disengage said gear with respect to said rack, said gear shaft, gear, and rack being arranged to position plate cylinder frame with respect to said crossarm when said gear is in engagement with said rack and said gear shaft is manipulated, a frame adjusting shaft, said plate cylinder frame having a bore for receiving said frame adjusting shaft in sliding motion, a releasable locking screw for locking said frame adjusting shaft in said bore in a preselected position, the other end of said frame adjusting shaft having a threaded portion, a manipulatable frame adjusting nut mounted on said threaded portion, said frame adjusting nut having a circumferential groove, a bracket fixedly mounted on the crossarm and receivable in said circumferential groove to prevent longitudinal movement of said frame adjusting nut by allowing rotational movement, said frame adjusting nut and said frame adjusting screw being arranged to move said plate cylinder frame with respect to said crossarm when said locking screw is in its locked position and said frame adjusting nut is rotated.

2. In a flexographic press having a plurality of printing stations with each station having an ink fountain roller, a printing plate cylinder and a related impression cylinder, the combination in each station comprising means mounting each of said printing plate cylinders for individual movement back and forth relative to its impression cylinder, means mounting each of said ink fountain rollers for individual movement back and forth relative to its printing plate cylinder, said means mounting in said printing plate cylinder including coarse adjusting means and vernier adjusting means, said means mounting said printing plate cylinder including a printing plate cylinder shaft, said printing plate cylinder being mounted on said printing plate cylinder shaft, a printing plate cylinder frame having upward extensions, said printing plate cylinder shaft being mounted on said extensions, a press frame having a crossarm, said crossarm having a printing plate cylinder frame keyway, said printing plate cylinder frame being slidably mounted on said cylinder frame keyway, said coarse adjusting means for adjusting the position of said plate cylinder with respect to said impression cylinder comprising a gear shaft, means for rotating said gear shaft, a gear mounted on said gear shaft, an elongated rack mounted on said crossarm, said gear shaft being arranged for transverse motion with respect to said rack, said gear shaft, gear, and rack being arranged to position said plate cylinder frame with respect to said crossarm when said gear is in engagement with said rack and said gear shaft is manipulated.

3. A flexographic press according to claim 2 wherein said vernier adjusting means for adjusting said plate cylinder with respect to said impression cylinder comprises a frame adjusting shaft, said plate cylinder frame having a bore for receiving said frame adjusting shaft in sliding motion, a releasable locking screw for locking said frame adjusting shaft in said bore in a preselected position, the other end of said frame adjusting shaft having a threaded portion, a manipulatable frame adjusting nut mounted on said threaded portion, said frame adjusting nut having a circumferential groove, a bracket fixedly mounted on said crossarm and receivable in said circumferential groove to prevent longitudinal movement of said frame adjusting nut but allowing rotational movement, said frame adjusting nut and said frame adjusting screw being arranged to move said plate cylinder frame with respect to said crossarm when said locking screw is in its locked position and said frame adjusting nut is rotated.

4. A flexographic press according to claim 2 including means for adjusting the rotational position of the printing plate cylinder with respect to the impression cylinder to correct the web registration between stations comprising a pair of mating helical gears, means mounting one of said gears in direct drive relationship with respect to said printing plate cylinder and means mounting the other of said gears in direct drive relationship with respect to said impression cylinder, means for adjusting the relative position between said pair of helical gears to provide partial rotational movement of said printing plate cylinder with respect to said impression cylinder.

5. In a flexographic press having a plurality of printing stations with each station having an ink fountain roller, a printing plate cylinder and a related impression cylinder, the combination in each station comprising means mounting each of said printing plate cylinders for individual movement back and forth relative to its impression cylinder, means mounting each of said ink fountain rollers for individual movement back and forth relative to its printing plate cylinder, said means mounting said ink fountain roller including coarse adjusting means and vernier adjusting means, means mounting said ink fountain roller including an ink fountain roller shaft, said ink fountain roller being mounted on said ink fountain roller shaft, an ink fountain carriage, said ink fountain roller shaft being mounted on said ink fountain carriage, a printing cylinder frame for carrying said printing plate cylinder and having a keyway for slidably receiving said carriage, means for adjusting the position of said ink fountain roller with respect to said printing plate cylinder comprising a gear shaft mounted on said printing plate cylinder frame, means for rotating said gear shaft, a gear mounted on said gear shaft, an elongated rack mounted on said ink fountain carriage, said gear shaft being arranged for transverse motion with respect to said rack, said gear shaft, gear and rack being arranged to position said ink fountain carriage with respect to said printing plate cylinder frame when said gear is in engagement with said rack and said gear shaft is manipulated.

6. A flexographic press according to claim 5 wherein said vernier adjusting means for adjusting said ink fountain roller with respect to said plate cylinder comprises a carriage adjusting shaft, said ink fountain carriage having a bore for receiving said carriage adjusting shaft in sliding motion, a releasable locking screw for locking in said carriage adjusting shaft in said bore in a preselected position, the other end of said carriage adjusting shaft having a threaded portion, said carriage adjusting nut having a circumferential groove, a bracket fixedly mounted on the plate cylinder frame and receivable in said circumferential groove to prevent longitudinal movement of said carriage adjusting nut but allowing rotational movement, said carriage adjusting nut and said carriage adjusting screw being arranged to move said ink fountain carriage with respect to said plate cylinder frame when said locking screw is in its locked position and said carriage adjusting nut is rotated.

7. A flexographic press according to claim 5 including means for adjusting the rotational position of said printing plate cylinder with respect to said impression cylinder to correct the web registration between stations comprising a main shaft mounted for rotation on a frame of said press, said impression cylinder being mounted on said main shaft, a first helical gear mounted on said main shaft, a second shaft mounted on said frame, a second helical gear mounted on said second shaft, a spur gear mounted on said second shaft, a printing plate cylinder shaft carrying said printing plate cylinder, a spur gear mounted on said printing plate cylinder shaft, gear means interconnecting said spur gear on said second shaft with the spur gear mounted on said printing plate cylinder shaft in driving relationship, said helical gears being constructed and arranged with respect to each other to cause

rotational movement of the printing plate cylinder with respect to the impression cylinder responsive to rotational and axial manipulation of the second shaft.

8. In a flexographic press having a plurality of printing stations with each station having an ink fountain roller, a printing plate cylinder and a related impression cylinder, the combination in each station comprising an ink fountain roller shaft, said ink fountain roller being mounted on said ink fountain roller shaft, an ink fountain carriage, said ink fountain roller shaft being mounted on said ink fountain carriage, a printing cylinder frame for carrying said printing plate cylinder and having a keyway for slidably receiving said carriage, a gear shaft rotatably carried by said printing plate cylinder frame, a gear mounted on said gear shaft, an elongated rack mounted on said ink fountain carriage, means movably mounting said gear shaft on said printing plate cylinder frame for selective relative movement of said gear into and out of operative engagement with said rack means and for manipulating said gear shaft when said gear is in operative engagement with said rack to selectively position said ink fountain carriage with respect to said printing plate cylinder frame.

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United States Patent [19]
Abendroth et al.

[11] **3,749,011**
[45] **July 31, 1973**

[54] **DAMPING DEVICE FOR LITHOGRAPHIC PRINTING PRESSES**

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[22] Filed: **Feb. 26, 1971**

[21] Appl. No.: **119,114**

[30] **Foreign Application Priority Data**

Mar. 5, 1970 Germany .... P 20 10 387.1

[52] U.S. Cl. **101/148,** 101/247
[51] Int. Cl. **B41l 25/16**
[58] **Field of Search** 101/137, 140, 144, 101/145, 147, 148, 184, 185, 192, 209, 351, 352, 247

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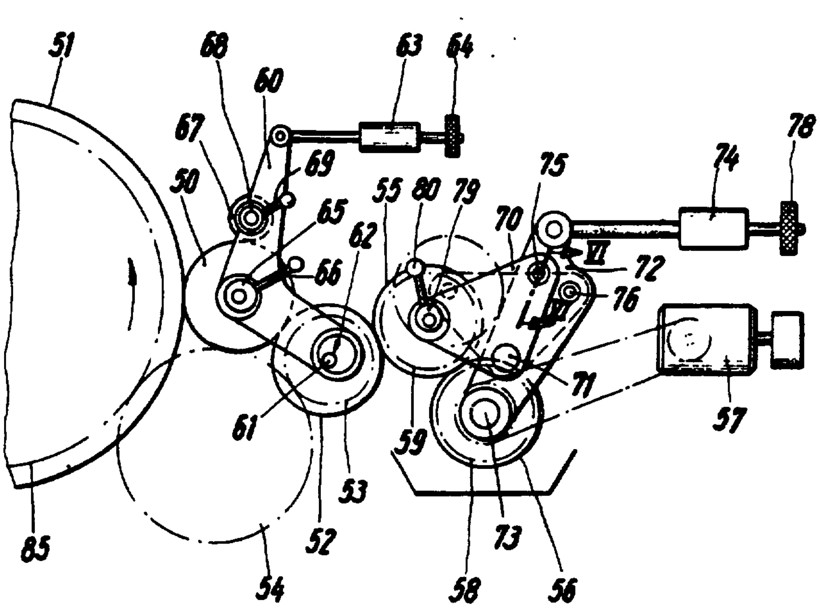
[57] **ABSTRACT**

A damping device for lithographic printing presses comprises a train of four rollers formed by a damping roller to engage the press plate cylinder and a distributing roller which in turn engages an intermediate roller in rolling contact with a fountain roller dipping in a damping solution container. The distributing roller and the fountain roller are both mounted on fixed axes, the other two rollers in the train having their axes on pivoted levers so that they can be brought into and out of engagement with each of the two rollers they respectively engage during operation of the press. The intermediate and damping roller mountings also include provision for adjustment of the inter-axial distance of the rollers. Movement of the rollers between engaged and disengaged positions may be manual or automatic.

8 Claims, 8 Drawing Figures



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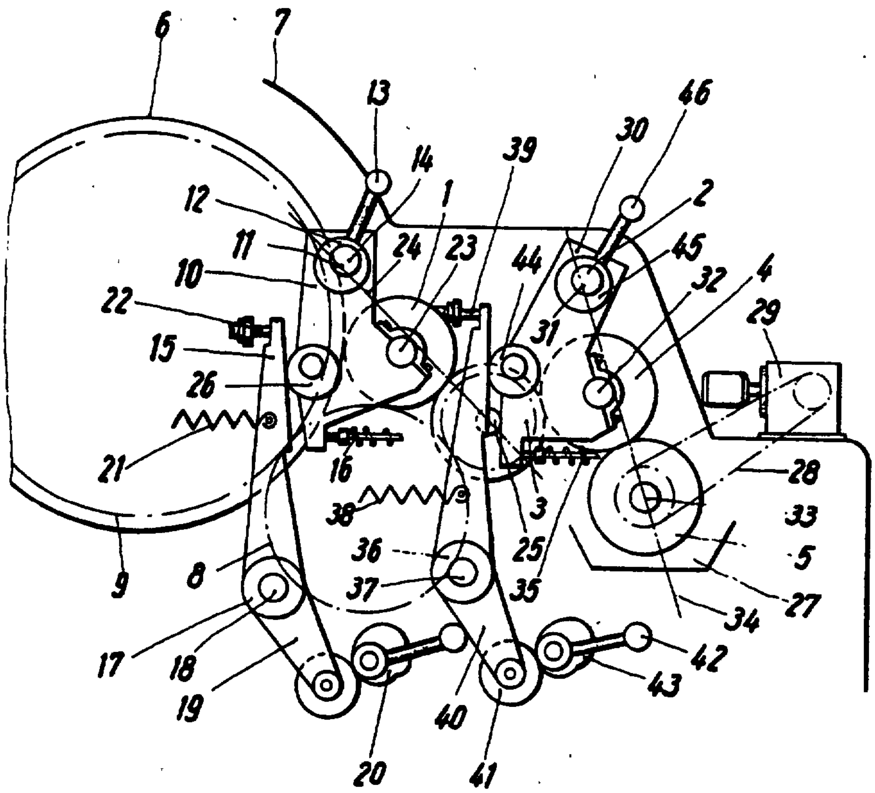

Fig.1

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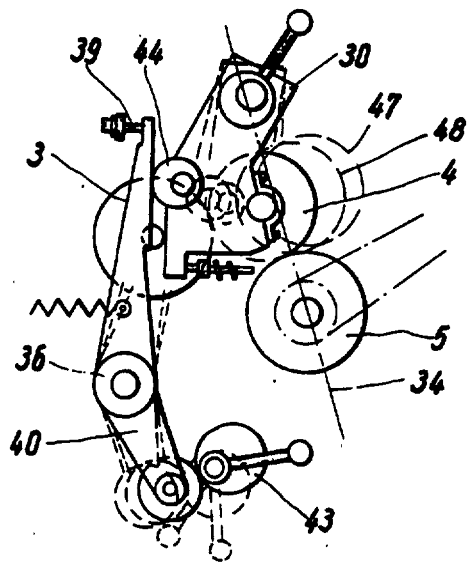

Fig.2

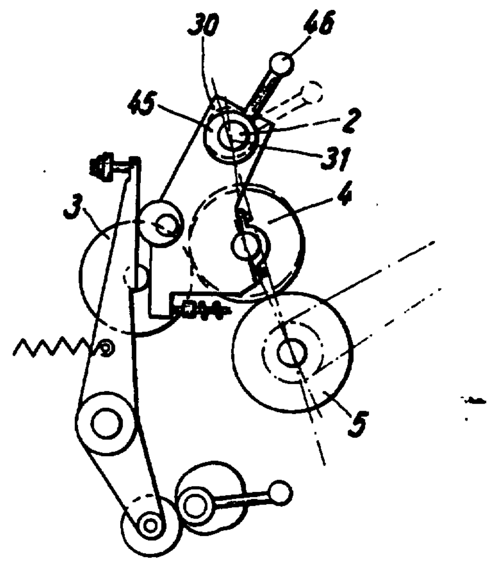

Fig.3

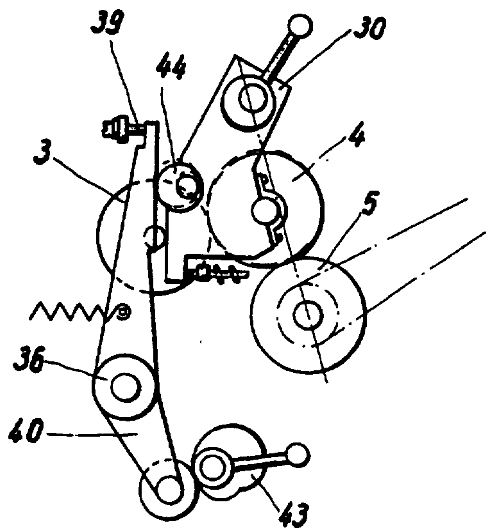

Fig.4

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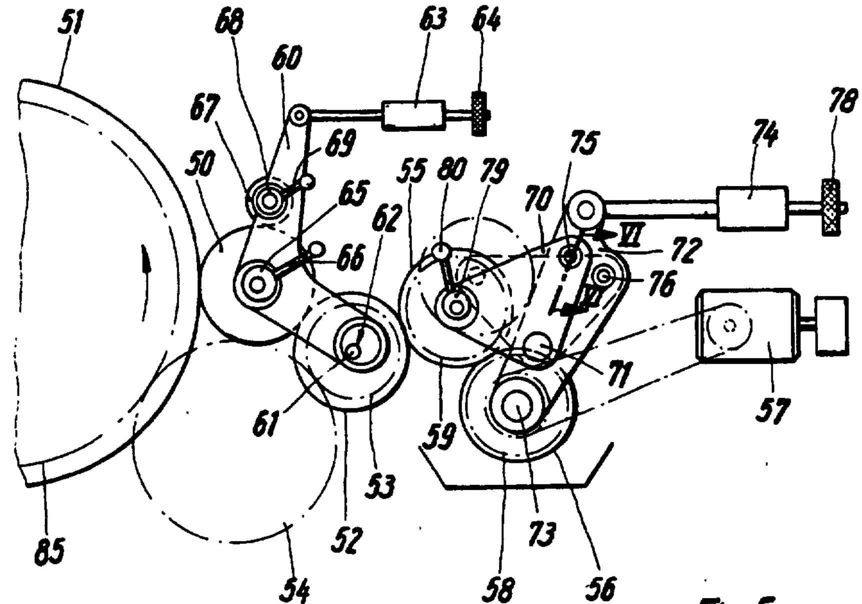

Fig.5

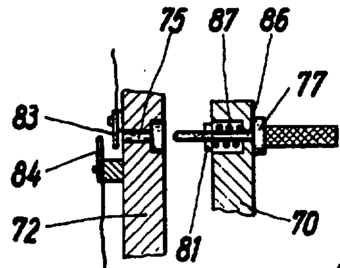

Fig.6

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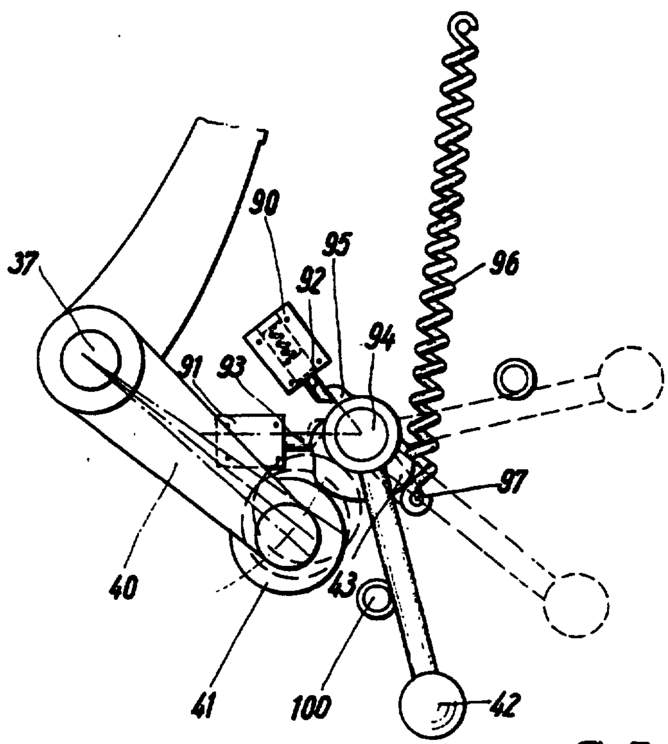

Fig.7

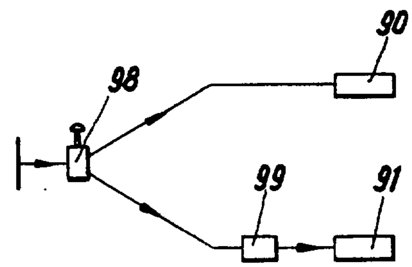

Fig.8

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W019102

DAMPING DEVICE FOR LITHOGRAPHIC PRINTING PRESSES

The invention relates to a damping device for lithographic printing presses having at least one distributing roller which runs on the plate cylinder and which is continuously supplied with damping solution by a fountain roller dipping into a damping-solution container and in turn followed by an intermediate roller and a distributing roller, the series-connected rollers being in uninterrupted contact during operation, and the supply of moisture being adjustable by varying the peripheral speed of the fountain roller.

Continuous working damping devices are not always accepted without reserve in practice although the advantages proved in principle are generally recognised. In fact, continuously working damping devices are more sensitive than those working conventionally.

In order to overcome this disadvantage, the rollers of known damping devices are mounted for adjustment in order to be able to set the mutual contact pressures finely. In a damping device according to United States Patent Specification No. 3,283,707, a damping roller, fountain roller and squeeze roller are all mounted for adjustment. The bearing arrangements in each case cannot, however, fulfil the tasks laid down in the invention.

Furthermore, a continuous working damping device is disclosed in United States Patent Specification No. 3,433,155, wherein four rollers are mounted one behind the other. In this damping device, the three rollers preceding the damping roller are displaceable horizontally, together with the drive motor for the variable drive of the fountain roller. In addition, provision is made for the fountain roller to be mounted adjustably in relation to the roller following it and this following roller in turn in relation to the distributing roller mounted next. The means described cannot, however, overcome the disadvantages occurring in continuous working damping devices. In addition, the design is complicated because the fountain-roller drive must likewise be adjustable in position.

It is the object of the present invention to overcome the disadvantages in previously known, continuous working damping devices. At the same time, the device is simpler in design and more reliable in operation. The invention is based on the idea that, in contrast to the fabric-covered, moisture-storing rollers of so-called lifter damping devices, the uncovered rollers of continuous working damping devices obviously have to be machined and adjusted in relation to one another much more accurately. Minor deviations in the roller radius, a slight radial out-of-true or deviations from the axis parallelism obviously have a greater effect. In the design of such damping devices, however, attention has not hitherto been paid to the fact that even manufacture within the closest tolerance ranges is not sufficient if care is not taken to ensure that the rollers retain their external shape during operation. Since relatively hard metal rollers generally co-operate with relatively soft rubber or plastics rollers, there is the risk of the rubber rollers being permanently deformed, particularly, of course, if the machine is at standstill for a long time. The difficulties with plastics rollers are already known, the running and transfer characteristics of which are altered in an unforeseeable manner by ageing. These difficulties are correspondingly increased by unilateral mechanical stressing. A design must therefore be found wherein the rollers, which are in contact in operation, can be slightly separated from one another when the machine is at a stand-still, and wherein the positively driven rollers are mounted in stationary supports. Furthermore, for reliable operation, care must be taken to ensure that, when the rollers are reengaged, only a roller which has already been moistened ever comes into contact with a roller which is still dry.

In the present invention the intermediate roller can be engaged, disengaged and adjusted in relation to both the fountain roller and also the distributing roller. By this relatively simple means, the fountain roller, the intermediate roller and the distributing roller can be completely separated from one another, and the distributing roller and the fountain roller can be mounted on stationary supports for the easier introduction of a driving torque. Thus it is possible to drive the fountain roller by means of a toothed belt which makes little noise, is free of servicing, has little stretch and in addition is inexpensive.

One embodiment of the invention provides for the damping roller to be able to be engaged, disengaged and adjusted in relation to both the plate cylinder and also of the distributing roller. Thus all the rollers mounted in the damping device can be separated from one another.

In one form of the invention, a device is provided for the gradual engagement of the intermediate roller first with the fountain roller and then with the distributing roller. Thus the operational reliability of the damping device is considerably improved because contact between two drive rollers and hence wear or even "seizing" of rollers is avoided. The gradual engagement may be effected by a construction in which the intermediate roller is mounted in a pivotable lever, the pivotal axis of which is so arranged that a partial pivoting of the lever brings the intermediate roller into contact with the fountain roller wetted with moisture and only further pivoting of the lever engages the now moistened intermediate roller with the distributing roller. It is often sufficient for the sequence of roller engagement to be prescribed while the timing of the sequence is left to the printer. In this case, a stepped cam lever is sufficient for the pivoting of the bearing lever. The position of the cam lever indicates to the printer whether the intermediate roller is engaged and if so where.

Structures in accordance with the invention may include a timing element which determines the difference in time between the intermediate roller being engaged first with the fountain roller and then with the distributing roller. Thus the prerequisites are provided for an automatic course of the engagement operation.

In a further embodiment of the invention, the intermediate roller is mounted in a first lever which is mounted for pivoting on a second lever, this second lever being mounted for pivoting about the axis of rotation of the fountain roller. With this arrangement, "switching through" as with a stepped cam is impossible, because the engagement with the particular roller is effected by pivoting a separate lever in each case. In addition, engagement, disengagement or positional adjustment of the intermediate roller in relation to the distributing roller is possible by pivoting the second lever about the axis of rotation of the fountain roller without the fine adjustment of the intermediate roller in relation to the fountain roller being altered.

W019103

In a further embodiment of the invention, two detents are provided which co-operate with the first lever and by means of which the engaged and disengaged position of the intermediate roller is determined in relation to the fountain roller, the fine adjustment between intermediate roller and fountain roller being effected by adjusting eccentric bearing bushes in which the intermediate roller is mounted. When eccentric bearing bushes are used, advantageous transmission ratios may be used for fine adjustment while the engagement and disengagement of the intermediate roller is effected by pivoting a lever between two end positions. By transferring the fine adjustment and the engagement and disengagement to members adapted to be actuated independently of one another, a particularly favourable design is possible for the particular purpose to be fulfilled.

In a development of the invention, a lock is provided which permits actuation of the second lever only when the first lever is in that stop position which corresponds to the engaged position of the intermediate roller in relation to the fountain roller. This ensures that the intermediate roller can only be engaged with the distributing roller when it is also engaged with the fountain roller. The fine adjustment of the intermediate roller in relation to the distributing roller can, however, be effected at any time independently thereof. The lock may be electrical in the form of a microswitch, the actuation of which is a prerequisite for a working cylinder or magnet becoming active, but it may also be mechanical in the form of a locking pawl.

The damping roller is preferably driven positively at the peripheral speed of the plate cylinder and a further distributing roller is provided which can be driven by friction over its circumference is engageable with and disengageable from the damping roller. It is particularly favourable to mount the distributing roller at a point situated after contact with the plate cylinder seen in the direction of rotation of the roller. A distributing roller brought into contact with the damping roller after contact with the printing plate has a satisfactory cleaning effect and its arrangement is necessary particularly with non-absorbent rubber damping rollers. Here, too, however, care must be taken to ensure that the distributing roller does not make any indentations on the damping roller and that it is separated from the damping roller at least during prolonged periods of standstill.

Embodiments of the invention by way of example are illustrated diagrammatically in the accompanying drawings in which:

FIG. 1 shows a side view of a damping device according to the invention;

FIG. 2 shows the diagrammatic illustration of the engagement or disengagement of an intermediate roller in stages in relation to a stationarily mounted fountain roller as shown in FIG. 1;

FIG. 3 shows the diagrammatic illustration of the fine adjustment of the intermediate roller in relation to the fountain roller as shown in FIG. 1;

FIG. 4 shows the diagrammatic illustration of the fine adjustment of the intermediate roller in relation to a distributing roller as shown in FIG. 1;

FIG. 5 shows the side view of a further embodiment of a damping device according to the invention;

FIG. 6 shows a detail on section line VI—VI in FIG. 5;

FIG. 7 shows a device for the automatic engagement of the intermediate roller in stages; and

FIG. 8 shows a flow chart of the automatic system shown in FIG. 7.

The damping device shown in FIG. 1 consists of a damping roller 1, a distributing roller 3, and intermediate roller 4 and a fountain roller 5. The damping roller 1 is in contact with the plate cylinder 6 of a printing press 7 indicated in outline, and the distributing roller 3. It is driven over tis circumference by frictional contact with the distributing roller 3 and the plate cylinder 6. The distributing roller 3 is positively driven, through an intermediate gearwheel 8, by a gearwheel 9 secured to the plate cylinder 6. The damping roller 1 is mounted in bearing levers 10 which are mounted for pivoting about the axis of rotation 11 of adjustable bushes 12 which are drilled eccentrically. The eccentric bushes 12 are mounted on pins 14 secured to the side walls of the machine and are turned by means of hand levers 13. Since both ends of the individual rollers are mounted in the same manner, the description is restricted to one side of the damping device. The pivoting of the bearing lever 10 and hence the adjustment of the damping roller 1 in relation to the plate cylinder 6 is limited by a stop 15 which is urged against the bearing lever 10 by a compression spring 16. The stop 15 is constructed in the form of a two-armed lever 17 which is mounted for rotation about a pin 18. One arm of the lever 17 represents the stop for the bearing lever 10 while the other arm is a roller lever 19 which is in contact with a two-step cam 20. The two-armed lever 17 is urged, by spring force 21, against an adjustable stop 22 and can be turned in clockwise direction by the stepped cam 20, against the spring force 21, for the purpose of disengaging the damping roller 1 from the plate cylinder 6, first stage, and for disengaging the damping roller 1 from the distributing roller 3, second stage. The axis of rotation 23 of the damping roller 1 lies, when the damping roller 1 is engaged with the plate cylinder 6, outside the straight line 24 which intersects the pivotal axis 11 and the axis of rotation 25 of the distributing roller 3 on the side of the line adjacent to the plate cylinder 6, so that disengagement of the damping roller 1 from the distributing roller 3 is only effected after a relatively great angle of pivoting of the bearing lever 10, corresponding to the second step of the stepped cam 20. The fine adjustment of the damping roller 1 in relation to the plate cylinder 6 is effected by turning a cam 26 mounted on the bearing lever 10. The fine adjustment of the damping roller 1 in relation to the distributing roller 3 is effected by turning the eccentric bush 12 by means of the hand lever 13.

The distributing roller 3, which is mounted in stationary supports, is in contact with the intermediate roller 4 to which the damping solution is transferred by contact with the fountain roller 5 dipping into a damping-solution container 27. The fountain roller 5 is likewise mounted stationary and is driven by a variable-speed electric motor 29 through a toothed belt 28. The intermediate roller 4 is mounted for pivoting about an axis 31 in bearing levers 30, in a similar manner to the damping roller 1. The axis of rotation 32 of the intermediate roller 4 engaged with the distributing roller 3 and a fountain roller 5 is likewise outside the straight line 34 intersecting the pivotal axis 31 and the axis of rotation 33 of the fountain roller 5, namely at the side adjacent to the distributing roller 3. The bearing lever 30 is urged, by spring force 35, against a two-armed

stop lever 36. This is mounted for pivoting about a pin 37 and is pulled towards an adjustable stop 39 by a tension spring 38. The other arm of the stop lever 36 is constructed in the form of a roller lever 40, the roller 41 of which is in contact with a two-step cam 43 which can be turned by means of a hand lever 42. It is obvious that a partial pivoting of the bearing lever 30, corresponding to the first step on the cam 43, merely brings the intermediate roller 4 out of contact with the distributing roller 3, and only further pivoting of the bearing lever 30, corresponding to the second step of the cam 43, brings the intermediate roller 4 out of contact with the fountain roller 5. The fine adjustment of the intermediate roller 4 in relation to the distributing roller 3 is effected by turning a cam 44 which is mounted on the bearing lever 30 and which is in contact with the stop lever 36. The fine adjustment of the intermediate roller 4 in relation to the fountain roller 5 is effected by turning a bearing bush 45 which is mounted eccentrically on a pin 2 and on which there is mounted the bearing lever 30, by means of a hand lever 46.

FIG. 2 shows the different positions of the intermediate roller 4 in relation to the distributing roller 3 and the fountain roller 5, which can be reached by pivoting the bearing lever 30 (shown in broken lines). The roller as shown in broken lines 47 is disengaged both from the distributing roller 3 and also from the fountain roller 5. The roller as shown in broken lines 48 is engaged only with the fountain roller 5 and not with the distributing roller 3. FIG. 3 likewise shows, illustrated in broken lines, the fine adjustment of the intermediate roller 4 in relation to the fountain roller 5 by turning the eccentric bush 45. The pivotal axis 31 travels over a circle about the pin 2. FIG. 4 shows, likewise in broken lines, the fine adjustment of the intermediate roller 4 in relation to the distributing roller 3 by turning the cam 44.

A further embodiment of a damping device according to the invention is illustrated in FIG. 5. This damping device likewise contains four rollers mounted one behind the other; a damping roller 50 which is in contact with the plate cylinder 51 and is driven by frictional contact over the circumference of the roller; a distributing roller 52 which is positively driven through gearwheels 53, 54 and 85; an intermediate roller 55 and a fountain roller 56. The fountain roller 56 is driven by an independent, variable-speed electric motor 57. The intermediate roller 55 may appropriately be driven by the fountain roller through a pair of gearwheels 58, 59. The gearwheel ratio may be 1 so that slip occurs between the rollers 52 and 55, but it may also be selected so that slip occurs between the rollers 55 and 56 or between both pairs of rollers 52, 55 and 55, 56. The damping roller 50 is mounted in a lever 60 which is pivotable about an axis 62 situated outside the axis of rotation of the distributing roller 52. The position of the axis 62 is selected so that, on pivoting of the lever 60, as a result of actuation of a pneumatic cylinder 63, the damping roller 50 comes out of contact both with the plate cylinder 51 and also with the distributing roller 52. The fine adjustment of the damping roller 50 in relation to the plate cylinder 51 is effected by adjusting the pneumatic cylinder 63 by means of a micrometer screw 64. The damping roller 50 is mounted in eccentric bushes 65. The fine adjustment of the damping roller 50 in relation to the distributing roller 52 is effected by turning these bushes 65 by means of hand levers 66. Furthermore, a further distributing roller 67 is mounted in the eccentric bushes 68 in the lever 60. By turning the eccentric bushes 68 by means of a hand lever 69, the distributing roller 67 can be engaged with or disengaged from the damping roller 50.

The intermediate roller 55 is mounted in a first lever 70 which is pivotable about a pin 71. The pin 71 is secured in a second lever 72 which is mounted for pivoting about the axis of rotation 73 of the fountain roller 56. The pivoting is effected by actuating a pneumatic cylinder 74. Two bores 75, 76 are provided in the second lever 72 (see also FIG. 6) and co-operate with a pin 77 mounted on the first lever 70 and so determine the two end positions of the pivoting of the lever 70. Thus, as a result of actuating the first lever 70, the intermediate roller 55 is engaged with or disengaged from the fountain roller 56, in the engaged state, independently of its fine adjustment in relation to the rollers 52 and 56. The fine adjustment of the intermediate roller 55 in relation to the distributing roller 52 is effected by adjusting the pneumatic cylinder 74 by means of the micrometer screw 78. The fine adjustment of the intermediate roller 55 in relation to the fountain roller 56 is effected by turning an eccentric bush 79 in which there is mounted the intermediate roller 55. The eccentric bush 79 is turned by means of a hand lever 80 but it may also be turned by means of a toothed-wheel gearing. The pin 77 is displaceable in a bore 86 in the first lever 70 as shown in FIG. 6. The pin 77 is urged into the position shown in FIG. 6 by the force of the compression spring 87 which is wound round the shank of the pin 77 and bears on the one hand against the first lever 70 and on the other hand against a disc 81 secured to the pin. Mounted at the bore 75 of the second lever 72 is a pair of contacts 83, 84 which can be closed by the pin 77. The pneumatic cylinder 74 can only be actuated if the pair of contacts 83, 84 is closed, that is to say if the pin 77 is engaged in the bore 75, that is to say the intermediate roller 55 is engaged with the fountain roller 56.

FIGS. 7 and 8 indicate in diagrammatic form how an engagement operation in steps can be made automatic. Two lifting magnets 90, 91 are provided, of which the armatures constructed in the form of stops 92, 93 project, in the de-energised state, within the pivotal range of a cam 95 which is secured to the shaft 94 and can be turned with this. Likewise secured to this shaft 94 is the two-step cam 43. A tension spring 96 engages on a strap 97 secured to the shaft 94 and causes this to turn in counter clockwise direction. The turning is prevented by a first stop 92 as shown in FIG. 7. On actuation of a circuit element 98 as shown in FIG. 8, the first magnet 90 attracts and permits turning of the shaft 94 until the cam 95 comes into abutment with the second stop 93. At the same time, as shown in FIG. 8, a timing element 99 is controlled which, after an adjustable interval of time, controls the second magnet 91, whereupon a further turning of the shaft 94 is effected until the hand lever 42 comes into abutment against an end stop 100.

What is claimed is:

1. A dampening device for a printing press including a rotary plate cylinder, said device comprising in combination: a train of rolls sequentially including a dampening roll, a distributing roll, a moistening fluid transmitting intermediate roll and a fountain roll, said rolls being movable into and out of fluid transmitting and

driving engagement with each other, said dampening roll being further movable into and out of fluid transmitting engagement with the plate cylinder, the distributing roll and the fountain roll being rotatable about stationary axes and the dampening roll and the intermediate roll being rotatable about pivotally displaceable axes; drive means for positively driving the dampening roll and variable speed drive means for positively driving the fountain roll; first setting means for moving the dampening roll into and out of engagement with the plate cylinder and the distributing roll, said setting means including a pivotal member mounting the dampening roll and actuating means coacting with said pivotal member for successively pivoting the same through a first distance for gradually engaging and reengaging, respectively, the dampening roll and the plate cylinder and subsequently through a second distance for gradually engaging and reengaging, respectively, the dampening roll and the distributing roll also; and second setting means for moving the intermediate roll into and out of engagement with the distributing roll and the fountain roll, said second setting means including a pivotal member mounting the dampening roll and actuating means coacting with said pivotal member for successively pivoting the same through a first distance for gradually engaging and disengaging, respectively, the fountain roll and the intermediate roll and subsequently through a second distance for gradually engaging and disengaging, respectively, the intermediate roll and the distributing roll also.

2. The dampening device according to claim 1 and comprising first fine adjustment means coacting with the pivotal member of the first setting means for selectively varying the engagement pressure between the plate cylinder and the dampening roll when the latter is set for engagement with the plate cylinder, and second fine adjustment means coacting with the pivotal member of the second setting means for selectively varying the engagement pressure between the fountain roll and the intermediate roll when the latter is set for engagement with the fountain roll.

3. The dampening device according to claim 1 and comprising delay means for controlling the time differential between moving the intermediate roll into engagement with the fountain roll and then with the distributing roll, said delay means including a first and a second stop supported by the pivotal member of the second setting means for turning in unison with said member, the first stop controlling turning of the pivotal member into the angular position for moving the intermediate roll into engagement with the fountain roll and the second stop controlling further turning of the pivotal member into the angular position for moving the intermediate roll into engagement with the distributing roll also, first solenoid means coacting with said first stop and second solenoid means coacting with said second stop, circuit means connected in circuit with said solenoid means, and a timing means included in said circuit means, energization of said circuit means activating the first solenoid means for releasing the first stop and also activating the timing means, said timing means activating the second solenoid means for release of the second stop after a predetermined delay time.

4. The dampening device according to claim 1 wherein the pivotal member of the second setting means comprises a first lever mounting the intermediate roll, and a second lever pivotally mounts said first lever, said second lever being pivotal about the rotational axis of the fountain roll.

5. The dampening device according to claim 4 wherein two detents in the second lever are engageable by means on the first lever forming stops whereby the engaged and disengaged position of the intermediate roll is determined in relation to the fountain roll, and wherein a fine adjustment between intermediate roll and fountain roll is effected by adjusting eccentric bearing bushes in which the intermediate roll is mounted.

6. The dampening device according to claim 5 and comprising a lock which permits actuation of the second lever only in the stop position of the first lever which corresponds to the engaged position of the intermediate roll in relation to the fountain roll.

7. The dampening device according to claim 1 wherein the actuating member of each of said setting means comprises a rotatable stepped cam member in engagement with the respective one of said pivotal members, turning means for rotating said cam member step-by-step, turning of the cam member through one step pivoting the respective pivotal member through said first distance and turning of the cam member through a second step pivoting the respective pivotal member through said second distance.

8. The dampening device according to claim 7 wherein each of said pivotal members comprises a two-arm lever, one arm of the levers forming a follower for the respective cam member and the other arm of the levers coacting with the dampening roll and the intermediate roll, respectively, for causing movements thereof into and out of engagement with the respective rolls as aforesaid.

* * * * *

W019106

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United States Patent [19]
Kumpf

[11] 3,768,438
[45] Oct. 30, 1973

[54] MACHINE FOR COATING SHEETS OF PAPER AND THE LIKE WITH LIQUID COATING MATERIALS

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[22] Filed: Sept. 1, 1971

[21] Appl. No.: 176,856

[30] Foreign Application Priority Data
May 19, 1971 Germany . . . P 21 24 825.9

[52] U.S. Cl. 118/262
[51] Int. Cl. B05c 1/06
[58] Field of Search .... 118/211, 212, 262, 118/248, 249, 239; 117/111 H, 111

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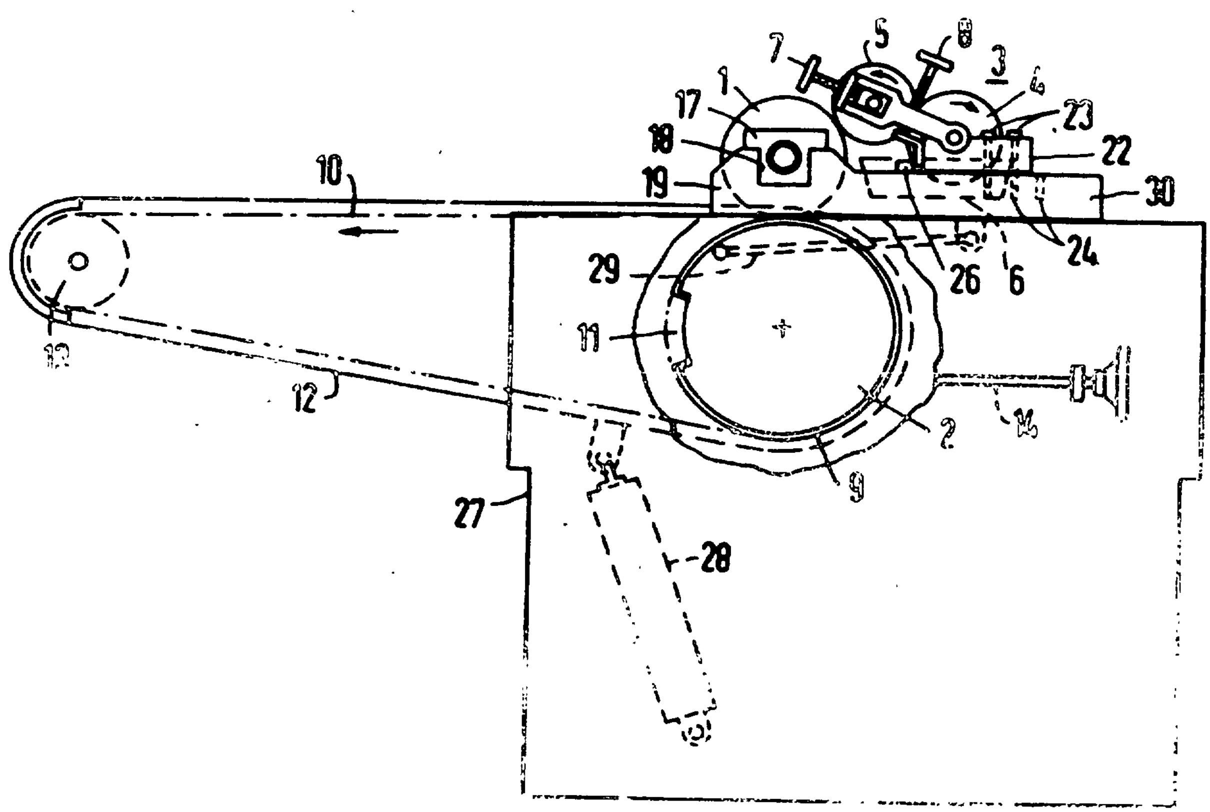
Primary Examiner—Henry S. Jaudon
Attorney—Jacobs & Jacobs

[57] ABSTRACT

A machine for coating sheets of paper and the like with liquid coating materials, in which the sheets are conducted without the application of pressure between a smooth coating roller and a larger diameter format roller, preferably rotating at different peripheral speeds, for coating the entire surfaces of said sheets, a feed roller accepting the coating material from a fountain roller dipping into a supply of coating material and transferring a film of desired thickness to the coating roller. For applying the coating material to predetermined parts of the surfaces of sheets the smooth coating roller together with special chocks mounted in bearing supports is removable from the machine and replaceable by a screen roller provided with screen surfaces corresponding to the surfaces that are to be coated. The screen roller revolves at the same peripheral speed and has the same diameter as the format roller, besides being mounted in taller chocks adapted to its larger diameter, but insertable into the same bearing supports. A doctor blade cooperates with the screen roller attachable to existing fixing means. The format roller is designed to withstand the high roller pressures required for gravure printing.

6 Claims, 3 Drawing Figures



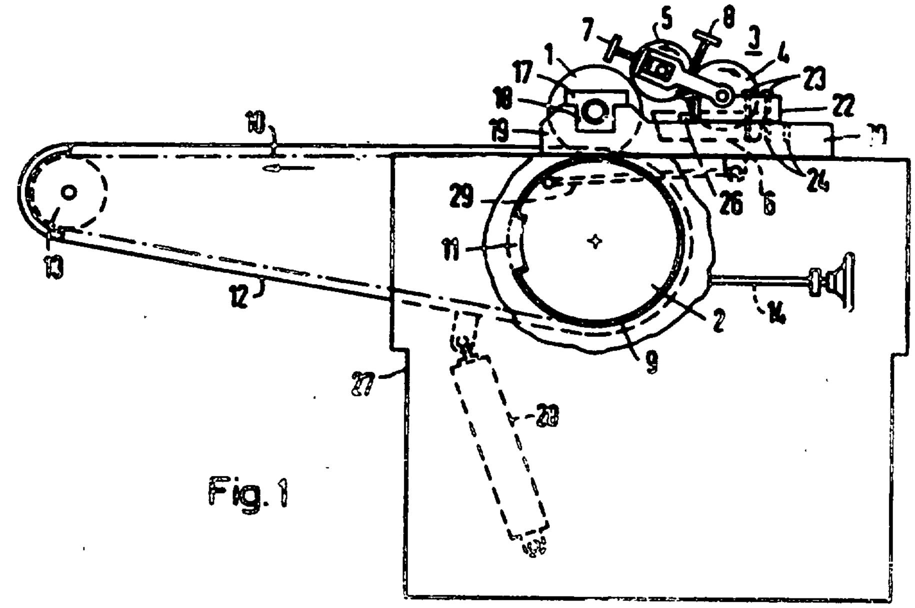


Fig. 1

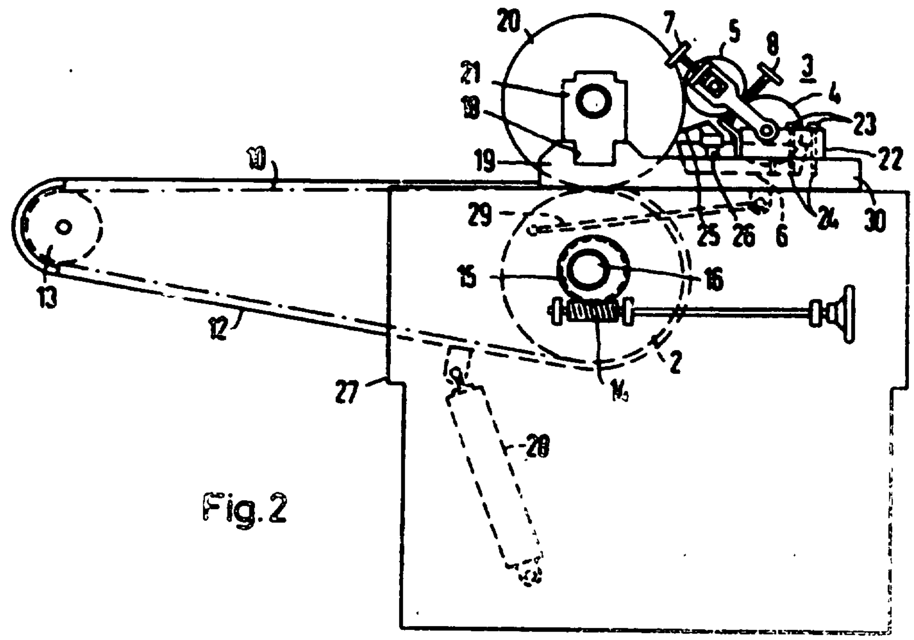


Fig. 2

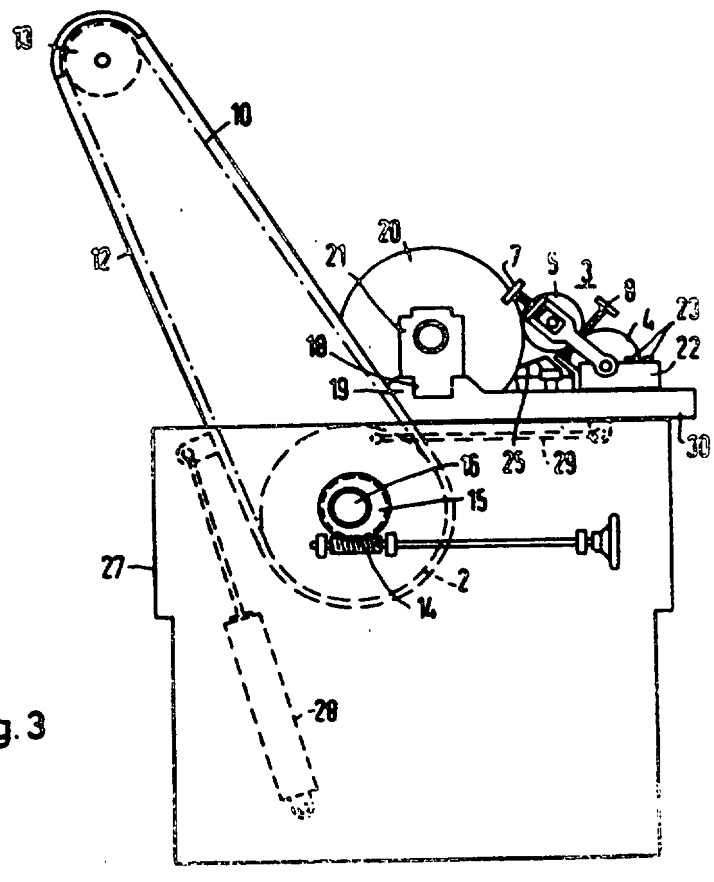


Fig. 3

MACHINE FOR COATING SHEETS OF PAPER AND THE LIKE WITH LIQUID COATING MATERIALS

BACKGROUND OF THE INVENTION

This invention relates to a machine for coating sheets of paper and the like with liquid coating materials, particularly with gloss or colored varnishes or adhesives. Coating the entire faces of sheets of paper usually presents no major difficulty. The coating material can be applied in the same way as the ink in rotary printing presses — by a system of rubber rollers. Substantially this system comprises a fountain roller which dips into a supply of the coating material and delivers the same through an intermediate transfer or feed roller in the form of a film of the desired thickness to a third roller which functions as a coating roller. The latter applies the material to the sheets which are conveyed through the gap between the coating roller and a cooperating counter-roller.

The counter-roller is analogous to a cylinder known in gravure machines as the "format cylinder." It will therefore hereinafter be described as the "format roller," because it likewise carries a rubber blanket underneath which a flat insert is placed of the same format as the sheet that is to be coated. The resultant raised backing for the sheet ensures that only the face of the sheet will be coated but that the remainder of the format roller will remain free of coating material.

However, contrary to gravure machines no pressure is exerted between the coating roller and the counter-roller, since otherwise the film of varnish or the like would be squeezed out. The two rollers are adjusted to leave a gap sufficiently wide to permit the coating material to be applied to the sheet by light contact. A gentle rubbing motion of the coating material is in fact advantageous. Consequently the coating roller and the counter-roller are driven at slightly different peripheral speeds. Analogously, no contact pressure is created between the fountain roller, the feed roller and the coating roller. They are likewise placed close enough for the transferred lacquer or like film to have the desired thickness. Since none of the four rollers is required to withstand major stability stresses each may be a lightweight metal cylinder, the coating, feeding and fountain rollers being provided with polished rubber coverings. Moreover, in order to achieve a more uniform distribution of the coating material that is applied to the sheets the circumference of the rubber coating roller is also shorter than the length of the sheet or the circumference of the format roller.

Lacquering and like coating machines of the described kind for coating one complete side of sheets are known in the art. They work satisfactorily and can be produced at low cost so that their employment is economically justified although they are merely auxiliary surface finishing machines that have a low product value compared to that of printing machines.

However, frequently the need arises not only of coating one complete side of paper or like sheets with liquid materials, but also of coating only particular parts of the sheet surface, for instance in the application of coloring or gloss varnishes to paper that is to be used for packing, when certain surfaces are to be kept free of varnish to enable them to accept glue. Moreover, in order to economise in the consumption of say varnish, it is advantageous to coat only those portions of the sur-

face that can later be seen, for instance in folding packages in which large parts of the paper surface are hidden.

In the printing art the inking of part of the surface of sheets is already done in color printing. For this purpose gravure machines are used in which the printing cylinder has a screen corresponding to the surfaces that are to be inked. An excess of ink is applied to these screens and the surplus is removed with a doctor. The ink which remains in the cells of the screen is then transferred to the sheet by the application of considerable pressure. Gravure machines of this kind are large and expensive rotary machines for the production of glossy magazines, books and the like. Their employment for partly coating sheets merely for the purpose of imparting to their usually previously printed surface a greater advertising appeal by the application of a gloss varnish or of providing certain portions with an adhesive would be entirely uneconomical. Machines for performing these latter tasks may cost only a small fraction of the investment cost of a gravure machine if they are to be economically acceptable.

It has also been proposed to solve the problem of coating part surfaces by using plate cylinders in which the surfaces that are to be coated — in the same way as the plates in relief printing — are in relief. However, difficulties arise in the distribution of the coating material, particularly at the edges of such plates.

SUMMARY OF THE INVENTION

The invention seeks to improve the first hereinabove described machine that comprises a rubber roller system for coating the entire side of sheets, the object of the invention being to modify such a machine without major expense so that it can be converted into a machine for coating only predetermined portions of the surfaces of sheets. This makes the provision of a second independent machine for such a purpose unnecessary.

For achieving this object the present invention consists in that for applying a coating material to predetermined parts of the surfaces of sheets the smooth coating roller together with a pair of special chocks mounted in bearing supports is removable from the machine and replacable by a screen roller provided with screen surfaces corresponding to the surfaces that are to be coated, the screen roller revolving at the same peripheral speed and having the same diameter as the format roller, besides being mounted in a pair of taller chocks that are adapted to its larger diameter but are nevertheless insertable into the same bearing supports, a doctor blade cooperating with the screen roller being attachable to existing fixing means and the format roller designed to withstand the high contact pressures required in gravure printing.

Since the circumference of the smooth rubber-covered coating roller for coating the entire face of the sheets must be shorter than the length of the sheets, and also than the circumference of a screen roller, in order to ensure a uniform distribution of the coating material on the face of the sheet, the feed roller must be withdrawn when the machine is re-equipped. For this reason a useful feature of the invention co[illegible] the [illegible] feed means for the coating material which in the conventional manner substantially comprise a fountain roller dipping into a supply of coating material, a feed roller accepting the coating material from the fountain roller and transferring the same as a film [illegible]

desired thickness to the coating roller, as well as adjusting means, are mounted as a unit assembly on a common frame portion which can be advanced and retracted a distance that makes allowance for the different diameters of the coating rollers that can be fitted into the machine.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other useful features of the invention will be understood as the following description of embodiments of the invention proceeds, in which reference will be made to the accompanying drawings which are illustrative schematic side elevations of essential parts of the proposed machine

FIG. 1 is a machine for coating the entire surface of sheets by means of a rubber roller,

FIG. 2 is a machine for coating required parts of the surface of sheets, and

FIG. 3 is the coating machine according to FIG. 2 showing the sheet feed means in raised position.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the coating machine illustrated in FIG. 1 a roller 1 has a polished rubber covering The purpose of this roller 1 is to apply a coating material to sheets that are conveyed from right to left in FIG 1 through the gap between the coating roller and a cooperating counter-roller 2. The coating roller 1 obtains the coating material from a feed assembly marked 3 substantially comprising a fountain roller 4, a feed roller 5 and a fountain 6 for the coating material. The fountain roller 4 dips into the fountain and transfers parts of the material which it picks up to the feed roller 5 which transfers a desired thickness of film to the coating roller 1. Adjusting means 7 and 8 are provided to adjust the roller clearances and the required thicknesses of the film of material that is transferred from the fountain roller 4 to the feed roller 5 and from said feed roller to the coating roller 1.

The counter-roller 2 is a format roller. A rubber blanket 9 is wrapped around its circumference and clamped in position Underneath the rubber blanket 9 is an insert which in size corresponds to the format of the sheet that is to be coated This insert creates a slightly elevated backing for the sheet. Consequently the coating material will be applied by the coating roller 1 only to the sheet and not to other parts of the format roller 2.

The individual sheets are positioned in relation to the insert by conventional gripper feed means travelling in an endless path at the peripheral speed of the format roller 2. The gripper feed means comprise two chains 10 adjacent the side faces of, and driven by the format roller 2. They are mounted on cross members spaced between the chains 10 at equidistant intervals but not shown in the drawings These grippers consecutively grip the sheets at the machine entry side, draw them through the gap between the two rollers 1 and 2 whilst being received into a longitudinal recess 11 in the format roller 2, and convey the sheets into proximity with a pair of return wheels 13 mounted some distance away on a cantilever frame 12, where the sheets are released

There is no contact pressure between the coating roller 1 and the format roller 2, these two rollers being adjusted to the appropriate clearance for the coating to assume the required thickness. For this purpose the format roller 2 has a fine adjustment for elevation, as illustratively indicated in FIGS. 2 and 3 by an eccentric bearing 15 for the format roller shaft 16, and a worm 14 for rotating the eccentric bearing.

The diameter of the coating roller 1 is significantly less than that of the format roller 2. It has been found that the uniformity of the coating applied by the coating roller 1 is disturbed at higher speeds before it makes contact with the sheet if the diameter of the roller exceeds a given size. Coating roller 1 and format roller 2 also have slightly differing peripheral speeds to generate a gentle rubbing action of the coating material.

For changing the machine over from the described process of coating the entire surface of the sheets, as shown in FIG. 1, to coating only one or more parts of the surface of the sheets, the smooth coating roller 1 is removed and replaced by a screen roller of the same diameter, and driven at the same speed as the format roller 2. In order to facilitate dismantling and assembling the rollers the coating roller 1 is mounted in special chocks 17 which are received into ways 18 in bearing supports 19 which they are bolted to.

Referring to FIG. 2 in which the same reference numerals as in FIG. 1 identify like parts, the screen roller 20 which has replaced the smooth coating roller 1 (FIG. 1) is likewise mounted in suitable chocks 21. Owing to the larger diameter of the screen roller 20 these chocks 17 are higher than those shown in FIG. 1, but they fit into the same ways 18 of the bearing supports 19. The same holes can also be used for bolting the chocks in position.

The position of the feed roller 5 must be adjusted to the larger diameter of the screen roller 20. In order to simplify this operation it is useful to combine the entire feed assembly 3, substantially comprising the fountain roller 4, the feed roller 5 including the adjusting means 7 and 8, and the fountain 6 itself, in a single unit assembly This may be mounted in a special portion 22 of the frame attached by screws 23 to its base. After undoing these screws 23 the entire multi-component feed assembly 3 can be moved back a suitable distance determined by tapped holes 24 for the reception of the screws 23.

The screen roller 20 is provided, directly on its surface or on a metal plate thereon, with a screen similar to that used in photogravure, the screen covering those parts which correspond to the parts on the sheets that are to be coated In order to remove from the regions outside the cells of the screen the unwanted coating material which has been applied to the entire surface of the screen roller 20, a doctor 25 is used which is mounted, together with its holder, on fixing means 26. In the simplest case the latter may merely be tapped holes for the reception of fixing screws

Whereas in a machine equipped with a rubber coating roller for coating the entire surface of the sheets the format roller is not submitted to contact pressure and may therefore be of light-weight construction, it is called upon, in the embodiment of the machihe according to FIGS. 2 and 3, to press the sheet against the screen roller with a considerable amount of pressure, as in gravure printing. The format roller 2 is therefore designed for withstanding such high pressures and remains in the machine even when the entire face of the sheet is to be coated and a rubber coating roller 1 (FIG 1) is used

Consequently, if it is desired to re-equip a machine using a rubber coating roller for coating the entire

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sheet surface for the purpose of coating only parts of the sheet surface, it is in practice only necessary, apart from one or two minor changes to be made in the machine itself, to provide an additional screen roller and a doctor, i.e., an expense which is in no way comparable to the cost of a second machine.

The change-over itself is likewise not very difficult and can be accomplished within a short time. The work can be significantly facilitated if the cantilever frame 12 carrying the pair of return wheels 13 can be hingeably raised. For this purpose the cantilever frame 12 which substantially consists of two sides that are connected together at suitable points may be hinged coaxially with the format roller shaft 16, either on this shaft itself or in a machine frame 27 in alignment therewith, the cantilever frame resting on supports provided on the machine frame 27 when in the working position shown in FIGS. 1 and 2. Lifting means, such as hydraulic ram cylinders 28 attached to each cantilever half, may conveniently be provided for raising the frame 12. To avoid the coating roller 20 or 1 (FIG. 1) being in the way, this roller may be retractable. For this purpose the bearing supports 19 may have extensions which carry the frame portion 22 supporting the coating roller assembly, the extensions forming a slide 30 movable in special ways in the machine frame 27. Two coupling rods 29 may be linked at one end to side members of the cantilever frame 12 and at the other end to the slide 30 in such a manner that when the cantilever frame 12 is raised the slide 30 will be automatically moved out of the way together with the assembly which it supports. When the cantilever frame 12 is raised the delivery side of the machine is fully accessible for the insertion and adjustment of the inserts on the format roller 2, for cleaning the rollers, exchanging the coating rollers 1 or 20 for inspecting, repairing and so forth.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The embodiments are therefore to be considered in all respects as illustrative and not restrictive.

What is claimed is:

1. A coating machine comprising (a) a frame, (b) a format roller rotatably mounted on the frame, (c) a pair of supports mounted on the frame parallel to the axis of the format rollers and operable to receive chock elements, (d) a first roller and chock assembly comprising (i) a pair of chocks mountable in the supports and (ii) a coating roller rotatably mounted in its associated chocks and being of a diameter smaller than that of the format roller, the chocks of said first assembly being of a height sufficient to dispose said coating roller and said format roller in parallel coating aligment without contact pressure, and (e) a second roller and chock assembly interchangeable with the first roller and chock assembly and comprising (i) a pair of chocks mountable in the support and (ii) a screening roller rotatably mounted in its associated chocks and being of the same diameter as said format roller, the chocks of said second assembly being of a height sufficient to provide contact pressure between said format roller and said screen roller.

2. A coating machine as defined in claim 1 including (a) coating material feeding means detachably mounted on said frame, said means comprising (i) a fountain roller operable to dip into a coating material reservoir, (ii) a second feed roller accepting coating material from said fountain roller and transferring the same to a third roller, said third roller being either said coating roller or said screen roller, (iii) means for adjusting the distance between the fountain roller and feeder roller and (iv) means for adjusting the distance between the feeder roller and said third roller, and (b) means for moving said coating material feeding means from a first position on the frame when said first roller and chock assembly is disposed in said supports to a second position when said second roller and chock assembly is disposed in said supports.

3. A coating machine as defined in claim 2 wherein said feeding means includes a doctor disposed to engage the screening roller when said second roller and chock assembly is disposed in said supports but not the coating roller when said first roller and chock assembly is disposed in said supports.

4. A coating machine as defined in claim 1, including stock feeding means, said feeding means comprising two endless chains with grippers mounted therebetween, said chains running at one end over chain wheels disposed coaxially with the format roller and at the other end over chain wheels disposed away from the delivery side of the rollers, said chain wheels being mounted on a cantilever frame which is hingeably raisable coaxially with the axis of the format roller.

5. A coating machine as defined in claim 4, wherein the supports and feeding means are slideably mounted on the frame.

6. A coating machine as defined in claim 5, wherein the cantilever frame is coupled to the feeding means and supports so that raising the cantilever frame about its hinge displaces the support and feeding means from their working position and lowering the cantilever frame returns the support and feeding means to their working position.

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United States Patent [19]

Egnaczak

[11] **3,800,743**

[45] **Apr. 2, 1974**

[54] **MATERIALS APPLICATION APPARATUS**

[75] Inventor: **Raymond K. Egnaczak**, Williamson, N.Y.

[73] Assignee: **Xerox Corporation**, Rochester, N.Y.

[22] Filed: **Mar. 1, 1971**

[21] Appl. No.: **119,914**

Related U.S. Application Data

[62] Division of Ser. No. 876,646, Nov. 14, 1969, Pat. No. 3,609,029.

[52] U.S. Cl. **118/259,** 117/17.5, 118/DIG. 23, 118/241, 118/637

[51] **Int. Cl.** **B05c 1/06,** B05c 1/08

[58] **Field of Search** ...... 118/DIG. 23, 637, 104, 118/203, 258, 259, 241, 242, 260, 268, 266, 50; 117/17.5, 37 LE

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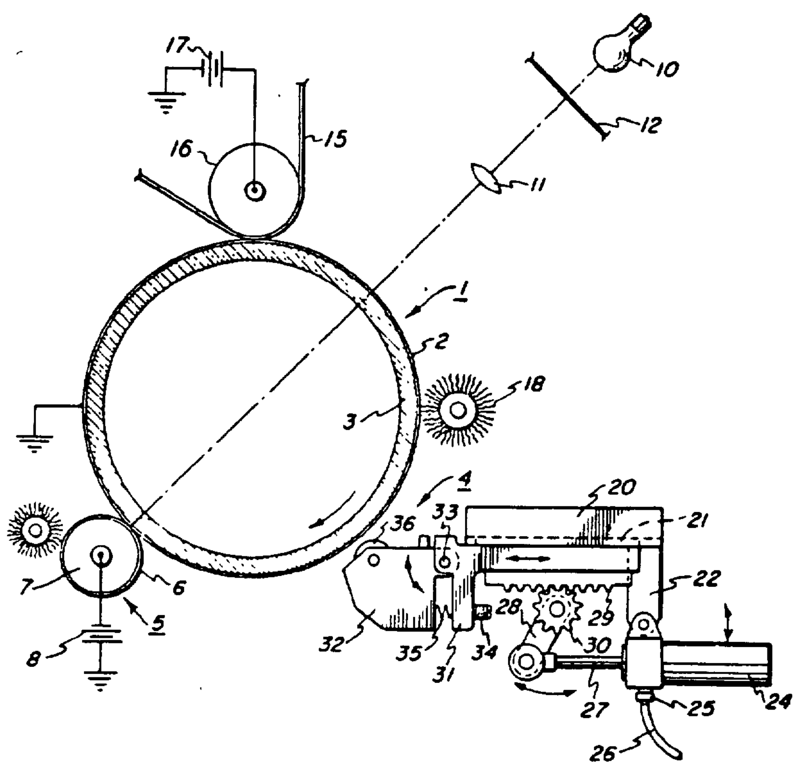
Primary Examiner—Mervin Stein
Assistant Examiner—Leo Millstein

[57] **ABSTRACT**

Apparatus for coating materials onto a surface comprising a housing pivotally connected to a carriage, a chamber and applicator within the housing. The pressure of the applicator against the surface to be coated is adjusted by varying the pivot of the housing containing the applicator relative to the carriage. The entire apparatus is advanced automatically into and out of contact with the surface to be coated. An alternative embodiment with an extruder applicator is also disclosed.

9 Claims, 4 Drawing Figures



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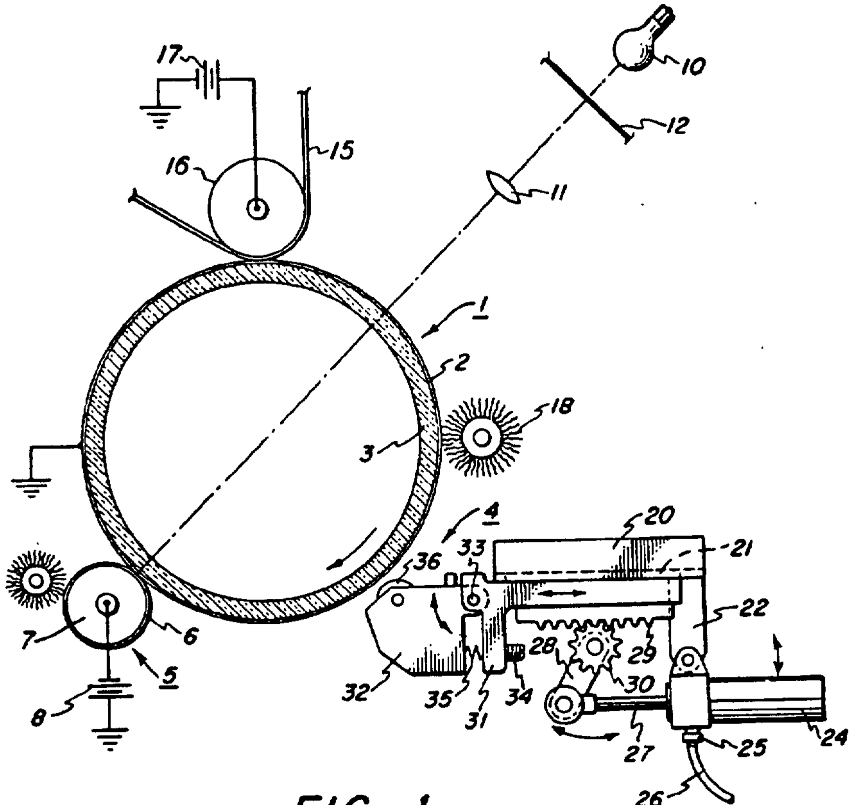
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FIG. 1

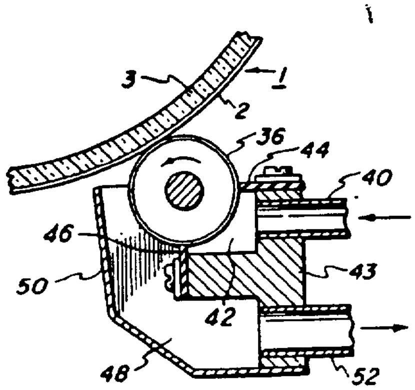
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FIG. 2

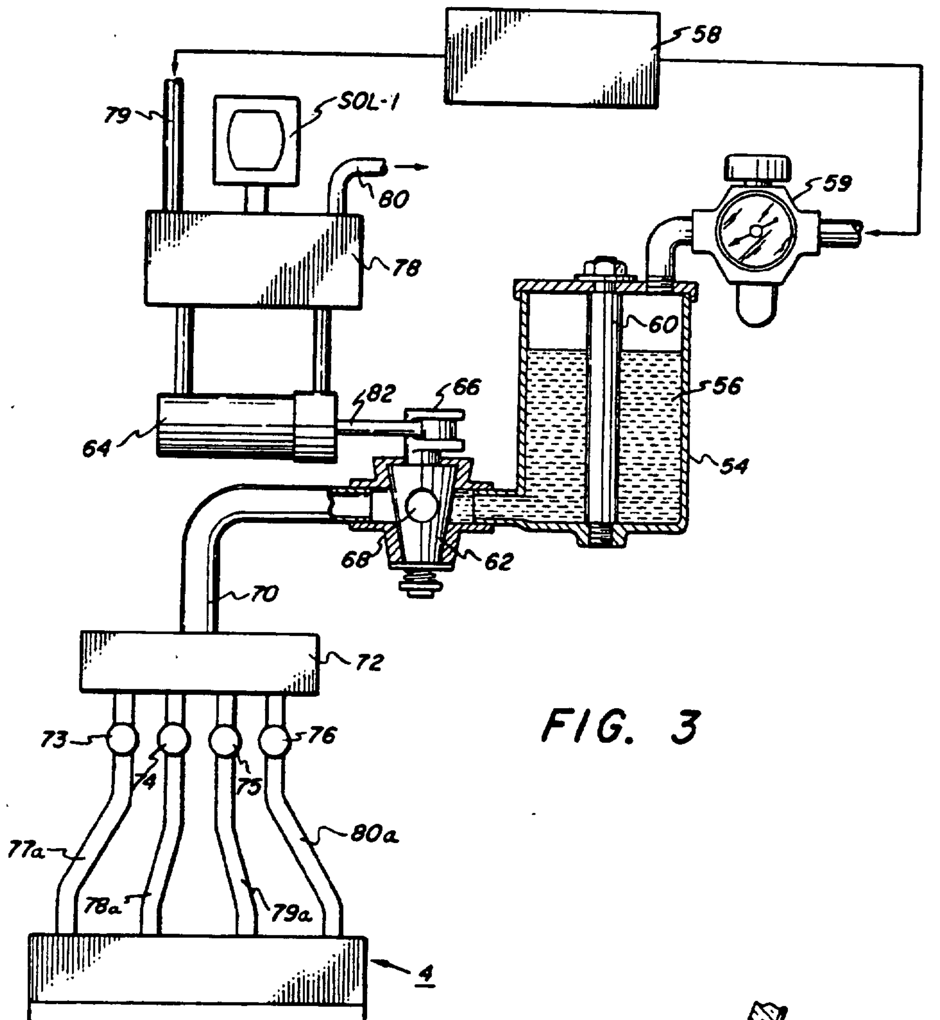
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FIG. 3

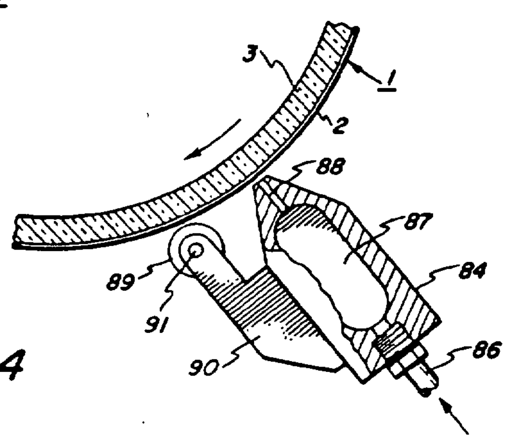
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FIG. 4

MATERIALS APPLICATION APPARATUS

This is a division of application Ser. No. 876,646, filed in the United States, Nov. 14, 1969, now U.S. Pat. No. 3,609,029.

This invention relates to coating systems and in particular to a fluid extruder system.

Systems exist that require working with layers of fluids, especially viscous liquids, that must be uniformly applied to a surface for working on the surface. One such system improved by a uniform coating technique and by the invention herein is the photoelectrophoretic imaging process. A detailed description of this process is given in U.S. Pat. Nos. 3,384,565, 3,384,566 and 3,383,993. These patents disclose how to produce a visual image at one or both of two electrodes between which a photoelectrophoretic particle suspension is placed. The particle suspension is comprised of photosensitive particles suspended within an insulating liquid carrier. The particles appear to undergo a net change in charge polarity or a polarity alteration by interaction with one of the electrodes upon exposure to activating electromagnetic radiation. The theory of operation is that the particles have a net charge when suspended in the liquid carrier and are attracted to the electrodes under the influence of an electrical field placed between them. Mixtures of two or more differently colored particles can secure various colors of images. The particles will migrate from one of the electrodes under the influence of an electric field when struck with energy of a wavelength within the spectral response of the colored particles.

Since the disclosure of the basic processes, continuous imaging machines have been disclosed, for example, in U.S. Pat. No. 3,427,242. It becomes important to be able to supply uniformly thin layers of the imaging suspension to one of the electrodes in such automated devices in order to form the best possible images from the machine.

It is also helpful in many instances to stress the suspension with a shear stress. This apparently improves the imaging qualities of the suspension.

Therefore, it is an object of this invention to improve fluid coating means. Another object of this invention is to improve means for uniformly coating liquids on a surface. Still another object of this invention is to extrude fluids onto a surface. Yet another object of this invention is to pre-stress fluids for application to a surface.

The invention herein is described and illustrated in a specific embodiment having specific components listed for carrying out the functions of the apparatus. Nevertheless, the invention need not be thought of as being confined to such a specific showing and should be construed broadly within the scope of the claims. Any and all equivalent structures known to those skilled in the art can be substituted for specific apparatus disclosed as long as the substituted apparatus achieves a similar function. It may be that other processes or apparatus will be invented having similar needs to those fulfilled by the apparatus described and claimed herein and it is the intention herein to describe an intention for use in apparatus other than the embodiment shown.

These and other objects of this invention are accomplished by employing a system for forcing fluids to a moving surface through an extruder mechanism adapted to supply a uniformly thin coating of the fluid

on the surface moving thereby. A smoothing means and a pulsed fluid manifold ensure the uniformity of the thin layer of fluid on the coated surface. These and other objects and advantages of this invention will become apparent to those skilled in the art after reading the description in conjunction with the accompanying drawings wherein:

FIG. 1 schematically represents an embodiment of this invention in conjunction with a photoelectrophoretic imaging system;

FIG. 2 is a close-up of the application member with portions broken away to show internal structure;

FIG. 3 is a fluid supply system shown, for example, for use in conjunction with the apparatus of FIG. 4; and

FIG. 4 shows an alternative embodiment of apparatus according to this invention.

There are certain terms of art used in conjunction with the photoelectrophoretic imaging process that should be defined. The "injecting electrode" is so named because it is thought to inject electrical charges into activated photosensitive particles during imaging. The term "photosensitive" for the purposes of this disclosure refers to the property of a particle which, once attracted to the injecting electrode, will alter its polarity and migrate away from the electrode under the influence of an applied electric field when exposed to activating electromagnetic radiation. The term "suspension" may be defined as a system having solid particles dispersed in a solid, liquid or gas. Nevertheless, the suspension used in the disclosure herein is of the general type having a solid suspended in a liquid carrier. The term "imaging electrode" is used to describe that electrode which interacts with the injecting electrode through the suspension and which once contacted by activated photosensitive particles will not inject sufficient charge into them to cause them to migrate from the imaging electrode surface. The imaging electrode is covered with a dielectric surface composed of a material having a volume resistivity preferably in the order of 10^7 or greater ohm-cm and a conductive member which is preferably a resilient material such as a conductive rubber used to give flexibility to the imaging electrode.

For photoelectrophoretic imaging to occur it is thought that these steps, (not necessarily listed in the sequence that they occur) take place: (1) migration of the particles toward the injecting electrode due to the influence of an electric field, (2) the generation of charge carriers within the particles when struck by activating radiation within their spectral response curve, (3) particle deposition on or near the injecting electrode surface, (4) phenomena associated with the forming of an electrical junction between the particles and the injecting electrode, (5) particle charge exchange with the injecting electrode, (6) electrophoretic migration toward the imaging electrode, (7) particle deposition on the imaging electrode. This leaves an optically positive image on the injecting electrode.

The schematic representation of FIG. 1 shows a photoelectrophoretic imaging apparatus having an injecting electrode 1 with a coating of a transparent conductive material 2 such as tin oxide over a transparent glass member 3. Such a combination is commercially available under the name NESA glass from Pittsburgh Plate Glass Company of Pittsburgh, Pa. However, other electrically conductive transparent coatings over transpar-

ent substrates are suitable for use herein. Imaging suspension is applied to the surface of the injecting electrode by the extruder mechanism 4 where it is carried because of the motion of the injecting electrode to the imaging area between the injecting electrode and the imaging electrode 5.

The imaging electrode 5 has a surface 6 composed of a dielectric material sleeve and a conductive substrate 7 which is preferably a resilient material such as an electrically conductive rubber. The imaging electrode prevents sufficient charge injection into the particles to cause them to migrate from its surface. The imaging electrode is connected to a potential source 8 while the injecting electrode is shown as electrically grounded to give the necessary field affect at the imaging area between the two electrodes. An exposure mechanism including an illumination means 10 and a lens 11 presents a flowing image of the object 12 at the image area which coincides with the optical image plane. The image is moving at the imaging area at the same rate as are the moving surfaces of the injecting and imaging electrodes. The image thus formed at the imaging area is carried by the injecting electrode to the transfer station where it is transferred to a support sheet 15. The transfer roller 16 is coupled to an electrical source 17 providing a field with the injecting electrode opposite in sign from that at the imaging area. A cleaning brush 18 removes residual particles from the surface of the injecting electrode so that the imaging cycle may be completed with other images being formed.

The extruder mechanism 4 is mounted on a brace 20 which has rails 21 therein. A stationary bracket 22 mounts an air cylinder 24 having an air inlet 25 and an air intake hose 26. The piston 27 of the cylinder, through the crank arm 28, moves a rack 29 and pinion 30 to engage and disengage the extruder in suspension application interface with the injecting electrode surface 2. The rack moves the extruder mounting 31 in the rails 21 of the brace 20.

The interfacing portion 32 of the extruder is pivoted about a pin 33 and is preset with an interface pressure adjusting screw 34 and an adjusting spring 35. The interfacing member shown in FIG. 1 is a smoothing rod 36 which can be grooved, wound wire, knurled, or smooth surfaced to present a uniformly thin layer of suspension on the injecting electrode surface.

FIG. 2 is a closeup of the interfacing portion 32 of the extruder with the side wall removed so that internal parts are seen. The suspension is pulsed in through the inlet tube 40 into a chamber 42 enclosed by the smoothing rod 36, a frame member 43, a coater blade 44 and a scraper blade 46. The smoothing rod 36 is driven with outboard oversize drive wheels pressed against the ends of the injecting electrode cylinder so that it moves when the wheels are in contact with the cylinder. A coater blade 44 limits the amount of suspension traveling around the periphery of the smoothing rod 36 for contact with the injecting electrode surface 2. The scraper blade 46 prevents used imaging suspension from contaminating the suspension held in the chamber 42 while preventing the suspension within the chamber 42 from leaking out of that chamber. The chamber 48 of the interfacing portion 32 of the extruder is a vacuum chamber for removing suspension materials within its housing walls 50. The materials are carried through the outlet 52 for removal from the vicinity of the injecting electrode and the imaging system. The drive wheels are larger in diameter than is the smoothing rod 36. The difference in diameter determines the clearance between the smoothing rod 36 and the surface 2. The thickness of the coated fluid on the surface is more or less equal to the clearance.

FIG. 3 demonstrates the gas and suspension supply system for the extruder. A few definitions of terms will be helpful at this point to more fully understand the use intended herein. A "negative pressure source" refers to a cylinder or other means which is partially evacuated of gases to lower its internal pressure below atmospheric pressure. Similarly a "positive pressure source" refers to a cylinder or other means containing a compressed gas to create an internal pressure greater than atmospheric pressure. The term "vacuum" refers to a negative pressure but not necessarily to an absolute void. The term "fluid" encompasses both gases and liquids The gases referred to are those commonly found in the atmosphere and identified generally as air.

The imaging suspension holding tank 54 maintains a quantity of imaging suspension 56 in its hermetically sealed chamber. Gases from the positive pressure gas source 58 enter the tank 54 through a gas regulator 59 which sets the positive pressure in the suspension holding tank 54. The mechanism 60 maintains the seals in the closure of the tank to prevent fluids escaping therefrom.

To reach the extruder 4, the suspension must pass through a valve 62 operated by a cylinder 64 and a crank arm linkage combination 66. The valve has a passage way 68 therein which, when turned in the proper direction, permits a pulsed shot of suspension to pass through the conduit 70 to the distribution manifold 72 for passage through the individual ink flow metering valves 73–76. The valve 62 is opened and closed by the action of the solenoid SOL-1 and the 4-way valve 78 having a gas intake conduit 79 and an exhaust conduit 80. The solenoid and 4-way valve operate to move the piston 82 of the cylinder 64 to rotate the valve 62 thus opening and closing the passageway. This connects the suspension 56 from the tank 54 to the conduit 70 allowing for pulsed shots of suspension through the distribution manifold 72 and conduits 77a-80a to the extruder 4.

An alternative embodiment for an extruder mechanism is shown in FIG. 4. An extruder housing 84 with a suspension intake connection 86 has an internal chamber 87 for accumulating suspension. The suspension is forced through the extruder at the exit aperture 88 for application to the surface 2 of the injecting electrode 1. To ensure that a smooth uniform layer of suspension moves to the imaging area, a smoothing rod 89 is placed downstream from the extruder along the path of movement of the surface. The smoothing rod is journaled through the support bracket 90 of a shaft 91 to freely rotate while being driven by the injecting electrode 1.

While this invention has been described with reference to the structures disclosed herein and while certain theories have been expressed, it is not confined to the details set forth; and this application is intended to cover such modifications or changes as may come within the purposes of the improvements and scope of the following claims.

What is claimed is:

1. A coating apparatus comprising:

a. a carriage;

b. a housing pivotally connected to said carriage;

c. an applicator mounted in said housing and adapted to be brought into contact with a surface to be coated;

d. a chamber defined by a portion of said housing, said chamber for maintaining a reservoir of coating material to be applied by said applicator;

e. pressure adjusting means to vary the contact pressure of said applicator against the surface to be coated by varying the pivot of said housing and said applicator relative to said carriage, wherein said pressure adjusting means is operatively connected between said carriage and said housing; and

f. drive means for advancing said carriage, said housing and said applicator into and out of contact with the surface to be coated.

2. Coating apparatus according to claim 1 wherein said applicator is a roller mounted for rotation in said housing and including in combination

a. a second chamber defined by a portion of said housing, said chamber for collecting coating material from the surface of said applicator roller after said roller has contacted the surface to be coated; and

b. removing means for removing uncoated material from said applicator roller portions after said portions have contacted the surface to be coated and to remove such material to said second chamber prior to the portions rotating into the chamber for maintaining a reservoir of coating material to be applied by said applicator.

3. The coating apparatus according to claim 2 wherein said removing means comprises a scraper blade which also separates said chamber and said second chamber.

4. Coating apparatus according to claim 3 wherein said second chamber is a vacuum chamber and further including in combination coating material removal means for removing coating material from said second chamber which has been scraped from said roller applicator.

5. Coating apparatus according to claim 3 including in combination supply means for supplying coating material under pressure to said chamber.

6. Coating apparatus according to claim 5 including in combination means for supplying metered amounts of coating material to said chamber comprising a pulsing valve means to enable pulsed shots of coating material to pass to said chamber.

7. Coating apparatus according to claim 3 further including in combination a smoothing means connected to said housing to form a uniform layer of coating material on the surface of said applicator roller after it has come in contact with coating material from said chamber but before it contacts the surface to be coated.

8. An extruder apparatus for applying coating material to a surface comprising:

a. a carriage;

b. an extruder housing mounted to said carriage, said housing defining an exit aperture;

c. a chamber defined internally by said housing, said chamber for maintaining a reservoir of coating material to be applied through the exit aperture;

d. supply means for supplying coating material to said chamber;

e. valve control means to enable pulsed shots of coating material to be supplied to said chamber and then through the exit aperture to a surface to be coated;

f. a smoothing rod mounted on said extruder housing downstream from said exit aperture along the path of movement of the surface to smooth the coating materials coated on the surface to be coated through the exit aperture; and

g. drive means for advancing said carriage, said extruder housing and said smoothing rod to and from the surface to be coated, so that said smoothing rod could be brought into and out of contact with said surface.

9. A coating apparatus comprising:

a. a carriage;

b. a housing pivotally connected to said carriage;

c. an applicator roller mounted for rotation in said housing and adapted to be brought into contact with a surface to be coated;

d. a chamber defined by a portion of said housing, said chamber for maintaining a reservoir of coating material to be applied by said applicator roller;

e. a second chamber defined by a portion of said housing, said chamber for collecting coating material from the surface of said applicator roller after said roller has contacted the surface to be coated;

f. removing means for removing uncoated material from said applicator roller portions after said portions have contacted the surface to be coated and to remove such material to said second chamber prior to the portions rotating into the chamber for maintaining a reservoir of coating material to be applied by said applicator, said removing means comprising a scraper blade which also separates said chamber and said second chamber;

g. pressure adjusting means to vary the contact pressure of said applicator roller against the surface to be coated by varying the pivot of said housing and said applicator roller relative to said carriage;

h. supply means for supplying coating material under pressure to said chamber, said supply means including means for supplying metered amounts of coating material to said chamber comprising a pulsing valve means to enable pulsed shots of coating material to pass to said chamber; and

i. drive means for advancing said carriage, said housing and said applicator roller into and out of contact with the surface to be coated, said drive means for advancing said carriage comprising:

i. a stationary brace slideably mounting said carriage,

ii. a rack mounted on said carriage,

iii. a rod,

iv. rod drive means for advancing said rod,

v. a pinion engaging said rack, and

vi. a crank arm connecting said rod and said pinion to translate the movement of said rod to said carriage.

* * * * *

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United States Patent [19]

Knodel et al.

[11] **3,916,824**

[45] **Nov. 4, 1975**

[54] **DEVICE FOR COATING STRIP MATERIAL IN CONTINUOUS OPERATION**

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[21] Appl. No.: **500,073**

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[52] **U.S. Cl.** **118/224**; 118/65

[51] **Int. Cl.**² **B05C 1/00**

[58] **Field of Search** 118/61, 68, 223, 224, 246, 118/249, 258, 259

[56] **References Cited**

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Assistant Examiner—Steven Hawkins
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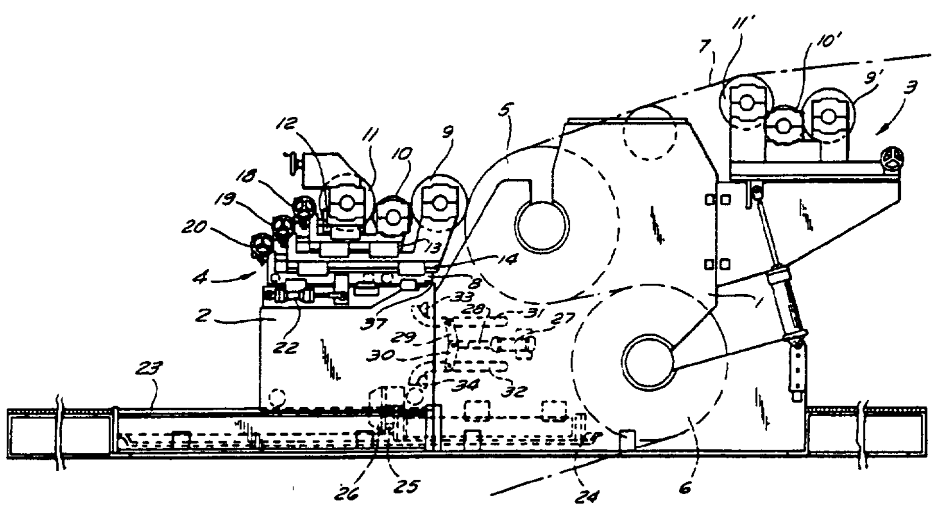
[57] **ABSTRACT**

There is disclosed a coating device for coating bands or ribbons with a coating material in continuous operation. The coating device comprises a main frame which mounts one or two deflector rollers for guiding and conveying the band or ribbon material to be coated. Coating is effected by a coating assembly which includes a fountain roll, a metering roll and an applicator roll which are disposed in axially parallel relationship and are adjustable relative one to another and relative to the band or ribbon to be coated as it is guided over one of the deflector rollers. The coating assembly is mounted on an auxiliary frame which is displaceable in the direction normal to the deflector roller over which the ribbon or band is guided. The auxiliary frame, in turn, is displaceable relative to the main frame for the purpose of making the rolls in the coating assembly conveniently accessible for cleaning or other servicing. There is further disclosed an installation including one or more coating devices in superimposition, each enclosed by an enclosure and drying and burning assemblies for purifying obnoxious or toxic pollutants entrained in the air passed through the enclosures of the coating devices before the air is discharged in the atmosphere.

11 Claims, 3 Drawing Figures



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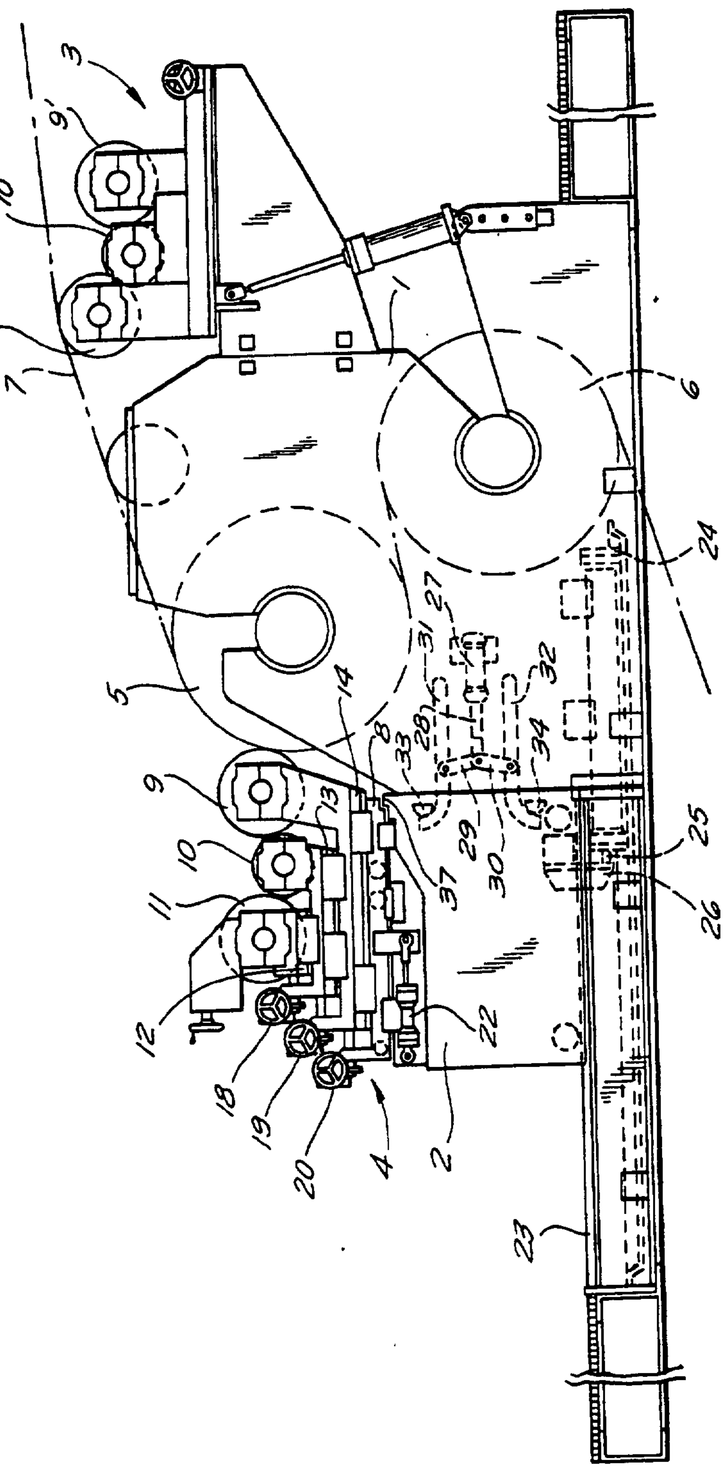
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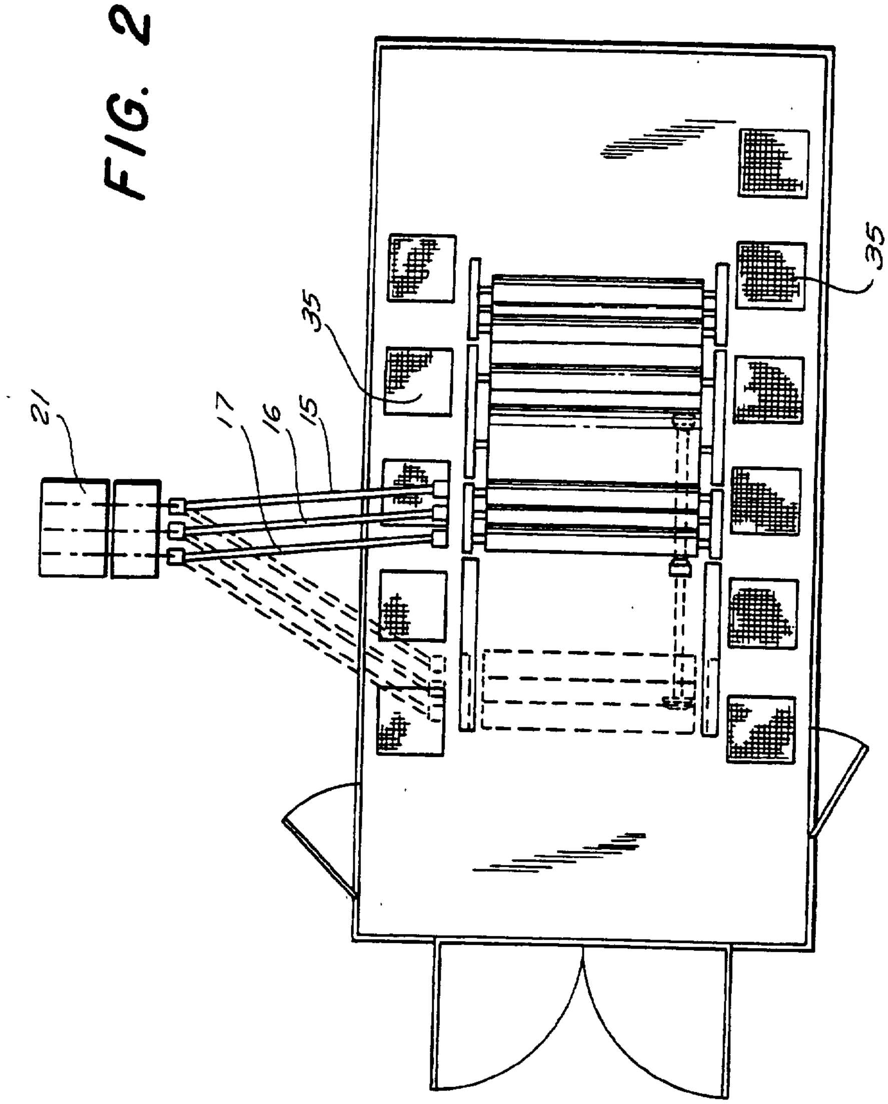
FIG. 1

FIG. 2



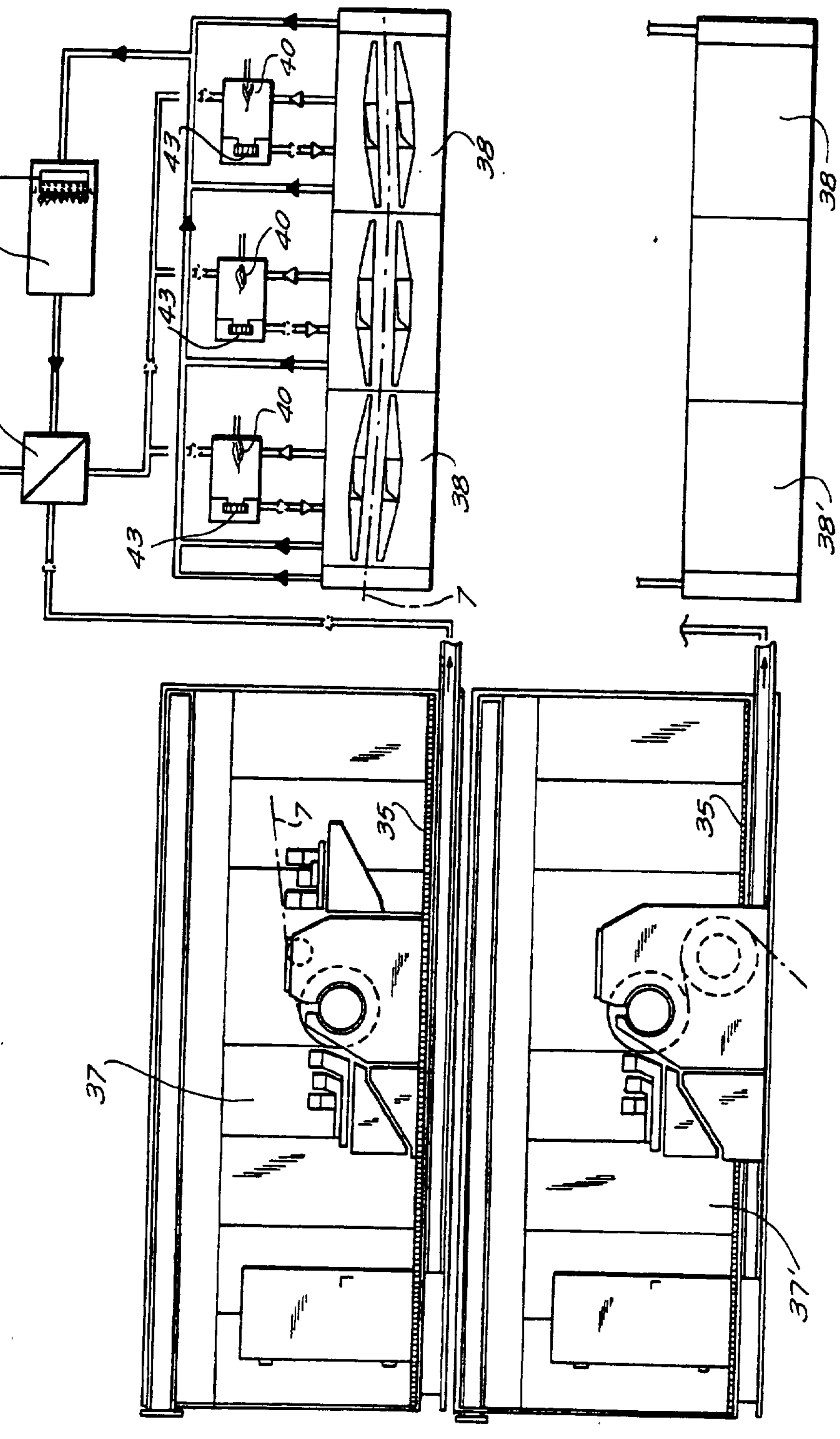


FIG. 3

DEVICE FOR COATING STRIP MATERIAL IN CONTINUOUS OPERATION

The invention relates to a coating device for coating material in ribbon or band form in continuous operation and also to an installation which includes such coating devices and purifying means for removing pollutants entrained in the air used for accelerating drying of the coating material after application thereof before the air is discharged into the atmosphere.

BACKGROUND

There are known coating devices of the general kind above-referred to which include one deflector roller or an upper and a lower deflector roller for guiding and conveying the band or ribbon material to be coated in continuous operation. In many instances the quality specifications with respect to the uniformity of the coating on the band or ribbon material is much greater for one side of the material than for the other side. In that case, the coating device for producing the high quality coating comprises a fountain roll for taking-up coating from a source of supply, a metering roll and an applicator roll. Such coating device for producing the high quality coating is mounted on a frame structure so that its position can be adjusted relative to the respective deflector roller.

Installations for coating band or ribbon material frequently comprise two coating devices to permit rapid changing from one type of coating material to another; for instance, it may be desired to change the color or the coating material. If two or even more coating devices are provided, the devices are generally arranged in superimposition and mounted on a common frame structure detachable therefrom. With an installation of this type, the band or ribbon side to be coated with the high quality coating being generally the upwardly facing sides, it becomes necessary to effect a thorough cleaning of the rolls of each coating device before a change in color or coating material can be effected. As is evident, if the cleaning is not thoroughly made any residues of the previously used material will cause irregularities in the coating made after the cleaning of the coating device.

The need for such thorough cleaning of the coating devices is well understood in the art and to make such cleaning possible it is known to arrange the coating devices in the installation so that each of the coating devices can be laterally withdrawn to assure that the coating devices are accessible for cleaning. The disadvantage of such laterally displacement as is now known is that considerable space is required for the coating device itself and such high space demand, in turn, greatly enlarges the total space required for the complete coating installation, i.e., including the assembly or assemblies needed for removing of pollutants that are unavoidably entrained in air passed through the coating devices. Virtually all coating materials contain volatile pollutants that are noxious and sometimes even toxic so that the air must be thoroughly purified before it can be discharged into the atmosphere. Arrangement of two superimposed coating devices, each coacting with a deflector roller makes it difficult to provide adequate accessibility to the fountain roll, metering roll and applicator roll of the coating devices for the purpose of thorough cleaning. In particular, considerable difficulties are encountered if the rolls of both coating devices are to be cleaned.

Moreover, lateral withdrawal of the rolls of each of the coating devices for purpose of cleaning also requires that each such roll is detached from its drive and such detachment, in turn, creates another problem since thorough cleaning of the rolls must be made while the rolls are turning. Hence, to effect such turning the rolls must be coupled to an auxiliary drive. After completion of the cleaning each roll must be detached from the auxiliary drive and re-attached to the drive of the device. All such decoupling, cleaning and recoupling obviously requires considerable time and labor and, thus, a corresponding increase in costs.

The sealed enclosure of the installation, i.e., the enclosure in which the coating device proper is located, is connected with a suitable suction pump for sucking off the volatile components released by the coating material. Such suction pump and the conduits connected therewith should be laid out so that a rapid air exchange is obtained to provide acceptable air conditions for the service personnel. The volume of air discharged from the space in which the coating is carried out can be fully fed to the drying assembly for drying of the coating material applied in the coating device only if and when this volume of air does not exceed the air requirements of the drying assembly. The drying assembly is coupled in its downstream position with an after-burning device. The purpose of such after-burner is to assure reasonably complete elimination of noxious or toxic pollutants. The level of air purification is generally controlled by strict codes which provide that the air discharged into the atmosphere cannot include more than a definite maximal percentage of pollutants.

To hold the operational costs of such after-burner assemblies as low as possible, efforts have been made to assure that the total volume of discharged air is reduced to an absolute minimum. To obtain optimal operational conditions for the installation it is advantageous that the total volume of air discharge can be processed in one after-burner assembly. However, such processing of the total air volume presupposes that the volume of air is discharged from the enclosure including one or more coating device can be fed to a drying assembly. This is only possible if the enclosed and sealed space for the coating devices, i.e., the overall dimensions of the enclosures for the coating devices is already at a minimum.

THE INVENTION

It is a broad object of the invention to provide a novel and improved coating device of the general kind above referred to in which the enclosure for the coating device and the coating device itself are reduced to minimal dimensions while at the same time obtaining maximal accessibility of the coating device for cleaning and other servicing.

Another object of the invention is to provide a novel and improved installation so arranged that the air flow which, after passing through enclosures for the coating device or devices has entrained therein pollutants, is limited to a volume of air which can be purified at optimal conditions.

SUMMARY OF THE INVENTION

The afore-pointed out objects, features and advantages and other objects, features and advantages which will be pointed out hereinafter are obtained by provid-

ing a coating device including a main frame structure, an auxiliary frame structure and a coating applicating assembly. The auxiliary frame structure supports the applicating assembly so that the same is displaceable in the direction normal to the path of the band or ribbon to be coated and is, in turn, supported by the main frame structure so that it can be displaced relative to said frame structure and also be detached therefrom. As a result, the over-all dimensions of the enclosure for the coating device can be selected so that the volume of air which must be passed through the enclosure during the coating operation can be held within limits which permit purification of the discharged air under optimal conditions and thus the volume of air continuously sucked out from the enclosure during a coating operation remains continuously at a rate which allows the use of economically acceptable after-burner assemblies. The discharge openings in the enclosures now need to be provided lengthwise of the bottom of the enclosure extending rows while heretofore additional crosswise extending air discharge openings were required.

The installation according to the invention further provides optimal accessibility of the coating devices proper so that servicing thereof, especially if, for instance, change in the color of the coating material is to be effected, can be carried out without considerable loss of time and without likelihood of insufficient cleaning of the rolls and other components of the coating device that need cleaning in case of change in the coating material.

After withdrawal of a coating device into the servicing position by a suitable power drive such as a servo system, the service personnel can clean or otherwise service the rolls of the coating devices while the rolls continue to rotate, as it is necessary for thorough cleaning and to effect such cleaning without first disconnecting the rollers from their operational drive means.

More specifically, the thorough cleaning of the rolls and other parts of the coating devices can be effected as sufficient space is available in a coating device according to the invention between the coating devices proper and the deflector roller over which the band or ribbon to be coated is guided during coating. Heretofore it was necessary for this purpose to effect time-consuming and complex lateral withdrawal or complete detachment of the coating device by means of a hoist. Such cleaning and other servicing of a coating device also results in avoidance of damage to the rolls which are comparatively expensive. Saving or reduction of the time required for cleaning the rolls of the coating device, and especially the applicator roll to effect rapid readying of the device in case of change in the color of the coating material or use of other coating materials, is of considerable economic significance, the more so as modern technique desires high conveying speeds for the band or ribbon to be coated. The importance of rapid readying of the coating device for re-start with a changed coating material is particularly important if comparatively small lots of bands or ribbon are to be coated. Obviously, the smaller the lot to be coated is, the more it becomes economically important to ready the entire installation for resuming operation with the changed coating material.

The invention also provides that the afore-referred to auxiliary frame structure is coupled to the main frame structure by means of clamping means which can be power operated, for instance by servo systems using hydraulic or air pressure. The use of such clamping means permits locking of the auxiliary frame structure to the main frame structure without tendency to vibrate, and simultaneously makes it easy to release the auxiliary frame structure from the main frame structure.

More specifically, operation of the clamping means is effected according to the invention by a power drive such as a cylinder-piston servo-system in which the connecting rod for the piston of the system mounts an angle lever mounting and operating clamping elements which are releasably engageable with complementary clamping elements on the auxiliary frame structure.

According to a further aspect of the invention, the auxiliary frame structure can be displayed relative to the main frame structure by a servo-system or other power drive which is mounted on the main frame structure. By operating this system, the auxiliary frame structure and with it the coating assembly supported on the same can be automatically detached from the main frame structure thereby obtaining clear space which is amply sufficient to carry out a thorough cleaning operation of the entire coating device without difficulty.

The air discharge and purifying parts and conduits which are disposed laterally of the main frame structure and the auxiliary frame structure can be used for immediate sucking out of air containing volatile pollutants or contaminants as may be released during a cleaning operation.

To permit continuous operation even during change of the coating material, the invention also provides that several coating devices are disposed each in a separate enclosure and in superimposition. These enclosed coating devices are connected with a common drying assembly and an after-burner assembly downstream of the drying assembly. The total discharge of contaminated air from the enclosures is fed to the drying assembly and the burner assembly by means of a suitable suction pump. Since the volume of air discharged from the enclosures in which the coating is carried out does not exceed the volume of air which can be accepted by the drying assembly, the total volume of air which contains a comparatively low amount of pollutants can be safely fed to the drying assembly. Additional content of pollutant as may be released in the drying assembly can subsequently be removed in the after-burner assembly. As a result, an additional after-burner assembly for the air discharged from the space in which coating is effected is thus avoided.

BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawing, preferred embodiments of the invention are shown by way of illustration and not by way of limitation.

In the drawing:

FIG. 1 is a diagrammatic elevational view of a coating device for coating both sides of a band or ribbon material in continuous operation;

FIG. 2 is a simplified plan view of FIG. 1; and

FIG. 3 is a diagrammatic elevational view of an installation including coating devices according to FIG. 1 disposed in superimposition for simultaneously or singly coating ribbons or bands and further including an air-purifying device.

DETAILED DESCRIPTION OF THE DRAWING

Referring now to the figures in greater detail, and first to FIG. 1, the coating device exemplified in this figure comprises a main frame structure 1 and an auxiliary frame structure 2. These frame structures mount

separate coating devices 3 and 4.

The main frame 1 further mounts two rotary deflector rollers 5 and 6 which serve to guide and convey a band or ribbon 7 to be coated. The auxiliary frame structure 2 mounts coating device 4 which is slidable relative to this frame structure by means of a guide slide 8. The coating device 4 is designed for coating the top or exposed side of band or ribbon 7 while coating device 3 serves for coating or otherwise treating the back side of the band or ribbon. The coating material may be any material suitable for the purpose, such as a dye, paint, lacquer, liquefied plastic, etc. Both coating devices are substantially alike as to their functional arrangement except that the coating device 4 being designed for coating the top side of the band or ribbon must be and is designed to effect a coating which satisfies high demand for uniformity, accuracy and similar requirements. Accordingly, device 4 includes various adjustment and control means which are not required for coating device 3 if, as is frequently the case, the demands on the quality of the coating on the back side are much lower than those for the coating of the top side.

Coating device 4 comprises an applicator roll 9, a fountain roll 10 for taking-up the coating material to be applied, and a metering roll 11. Similarly, the coating device 3 comprises an applicator roll 9', a fountain roll 10' and a metering roll 11'.

In addition to the afore-listed rolls, coating device 4 comprises guide carriers or slides 12, 13 and 14, each supporting one of the rolls. The positions of these slides and thus of the rolls relative one to another are adjustable by fine setting means such as hand wheels 18, 19 and 20 so that the cylindrical wall of the rolls are in coacting engagement, or in other words, the peripheral surface of one of the rolls rolls off the peripheral surface of the adjacent roll or rolls. Each of the three rolls is drivingly coupled by couplings 15, 16 and 17, respectively, with a separate drive means 21 (see FIG. 2).

Moreover, the entire coating device 4 can be by means of guide slide 8 which carries the guide slides 12, 13 and 14, displaced relative to the upper deflector roller 5 by means of a cylinder-piston-servo means 22 having a short stroke until stopped by an adjustable stop 37. The servo means 22 can be driven hydraulically or by air pressure. The purpose of the servo means is to move the coating device clear of the band when and while joints of lengths of band or ribbon pass the coating device, as such joints generally are somewhat thicker than the normal thickness of the band. After the passage of such joint the coating device is returned into its coating position. Control of the servo means can be automatically effected, for instance, by means of photocells or other control means conventional readily available in the market. The application of coating material is effected by transfer of material taken up by fountain roll 10 to metering roll 11, and finally, to applicator roll 9, which applies the coating material upon the upward facing band or ribbon 7 as the same is being guided and conveyed by deflector roll 5.

If the coating material is to be changed, for instance if material having a different color is to be used, rolls 9, 10 and 11 of coating device 4 and possibly other components thereof must be very carefully cleaned to prevent faulty coating such as discoloration, spots, etc. For the purpose of such cleaning, the entire coating device 4 can be displaced in the lengthwise direction of the coating device, that is, normal to the axis of roller 5, to a position in which there is free and convenient access

to the device for cleaning the rolls and possibly other components.

To effect such convenient displacement of the coating device into and out of its operational position for the purpose of cleaning, the auxiliary frame structure 2 is displaceable on a guide means 23 which is mounted on the base or inserted into the base of auxiliary frame structure 2. Displacement of frame structure 2 is effected by suitable adjustment means such as a hydraulically operated servo-piston system 24. This servo-system is fixedly secured to main frame structure 1 and the piston rod 25 of system 24 can be moved into engagement with protrusions such as studs 26 on frame structure 2. Accordingly, by operating the servo system 24, its piston rod 25 can be used to move coating device 4 via auxiliary frame structure 2 into and out of its operational position

Setting of auxiliary frame structure 2 and coating device 4 relative to deflector roller 5 is effected in the following manner: First, piston rod 25 of servo system 24 is operated to couple frame structure 2 with frame structure 1. As a result, there is a force-transmitting connection between both frame structures by means of a further power operated, for instance, hydraulically by a cylinder-piston servo system 27. The piston 28 of this system mounts a linkage 29 and 30 to which are hinged locking elements 31 and 32 which, upon operation of servo-system 27 effect coupling with coupling noses such as discs 33 and 34 on auxiliary frame structure 2.

After connection of frame structure 2 to frame structure 1, fine adjustment of rolls 9, 10 and 11 is effected by hand wheels 18, 19 and 20, respectively.

Operation of coating device 3 is essentially the same as that of coating device 4, except that adjustment and clearing of rolls 9', 10' and 11' is not or only rarely required since the quality demands on the coating of the bottom side of band or ribbon are much less on the coating of the top side as previously explained.

Turning now to FIGS. 2 and 3, these figures show application of the invention to an installation including two or more coating devices so that minimum space requirement is combined with convenient servicing of the coating devices as hereinbefore described. Furthermore, the installation due to the arrangement of coating devices according to the invention can be so designed that the air released during operation of the coating devices can be conveniently and thoroughly purified. Many types of coating materials such as certain paints, dyes, etc. contain volatile components which are released during application and drying and are obnoxious or even toxic. Accordingly, purification of the discharged air is highly necessary and often required by local codes.

FIGS. 2 and 3 show diagrammatically an installation which fully utilizes the advantages of coating devices according to the invention. As it is shown in these figures, each of the two coating devices is enclosed in a separate sealed-off enclosure 37 and 37', respectively. The outside dimensions of these enclosures can be conveniently selected in accordance with the minimal space requirements of the main frame structure and the auxiliary frame structure of coating device 4. There are shown two coating devices disposed in superimposition and enclosed by enclosures 37 and 37', respectively Of course, there may be several enclosures side-by-side on the same level. More than two coating devices and enclosures therefor can be superimposed. Drying air after being drawn through the enclosures for the coating de-

vices is fed via discharge ducts **35** to air-purifying assemblies as it is shown in FIG. 3 to the right of the coating devices. Ducts **35** are preferably arranged parallel to each other as it is shown in FIG. 3 and also parallel to the bottom of the enclosures, thereby reducing the required space to a minimum. Moreover, due to such arrangement, the required air volume can be maintained so that the discharge of the total air volume from enclosures **37** and **37'** and the feed of this discharged air to the air purifying assemblies is made readily possible.

There is provided for each of the enclosures **37** and **37'** an air-purifying assembly. The assembly for coacting with enclosure **37** is fully shown and described, but the assembly for enclosure **37'** is only partly shown as the two assemblies are alike and function in the same manner.

The assembly coacting with enclosure **37** comprises a drying device **38** which, as shown, may be divided into several parts: a heat-exchanger **39**, burners **40**, one for each part of the drying device, an after-burner **41**, a suction pump **42**, and suction pumps **43**, one for each burner **40**. All these components are presumed to be of conventional design. The air used in enclosure **37** during the coating operations, which as previously becomes contaminated during and due to the coacting operations, is sucked out by means of suction pump **42** and fed via conduit **35** and heat-exchanger **39** to drying device **38**. The drying process in device **38** removes most of the contaminants in the air. The air is then returned to heat-exchanger **39** and from this exchanger to suction pump **42** through which it is discharged into the atmosphere. To assure still further purification of the air, the after-burner **41** may be interposed between the drying device and the heat exchanger. It has been found that reheating of the air while being dried in drying device **38** is necessary or, at least, desirable. For this purpose, part of the air in the drying device is sucked out by suction pumps **43** and exposed to the heat of burners **40** which causes not only reheating of the air but also the burning of pollutants or contaminants still contained in the air. The sucked-off air is returned into the drying device to be discharged therefrom into the atmosphere together with the air remaining in the drying device. Dotted arrowheads indicate the feed of air from the enclosure **38** into the drying device and solid arrowheads indicate the flow of part of the air as caused by suction pumps **43**.

As several coating devices are arranged in superimposition in FIG. 3 and each one is enclosed in an enclosure there is no undesirable delay in the carrying out of a coating operation in one of the coating devices when a change in the coating material is effected in another coating device. In other words, all coating devices can be kept in operation except the one in which a change in the coating material is made.

In case two superimposed coating devices are used for coating the top side of bands or ribbons within the same installation vibrations may occur when one of the coating devices is withdrawn for cleaning purposes or change in the coating material. The result of such vibrations would be irregularities in the coating as effected by the second coating device. This danger is avoided by providing separation of the coating devices by enclosures as it is shown in FIG 3.

While the invention has been described in detail with respect to certain now preferred examples and embodiments of the invention, it will be understood by those skilled in the art, after understanding the invention, that various changes and modifications may be made without departing from the spirit and scope of the invention, and it is intended, therefore, to cover all such changes and modifications in the appended claims.

What is claimed is:

1. A coating device for coating bands with a coating material in continuous operation, said coating device comprising in combination:

a main stationary mounted frame structure;

rotary guide means for guiding band material to be coated, said guide means including at least one deflector roller and being mounted on said main frame structure;

a coating assembly for coating the side of the band outwardly facing on said roller, said assembly including a fountain roll for supplying coating material, a metering roll and an applicator roll disposed in axially parallel relationship one with the other and the deflector roller;

an auxiliary frame structure supporting said coating assembly, said auxiliary frame structure including guide means for slidably guiding said coating assembly as a unit in the direction normal to the rotary axis of the deflector roller for selecting varying positions of said assembly relative to said roller;

guide means on said main frame structure slidably supporting said auxiliary frame structure for selectively displacing the same in the direction normal to the axis as a unit relative to the main structure and thus relative to the deflector roller;

drive means for moving said auxiliary frame structure into a predetermined position relative to the main frame structure; and

locking means coacting with said auxiliary frame structure for releasably locking the same to the main frame structure.

2. A coating device in accordance with claim **1** wherein said drive means comprise a cylinder-piston servo means, the cylinder of said means being mounted on said main frame structure and the piston of said servo means being drivingly coupled with said auxiliary frame structure for displacing the same relative to the main frame structure by activating the servo means.

3. A coating device in accordance with claim **1** wherein said locking means comprise coating clamping members on the main frame structure and the auxiliary frame structure for releasably clamping the auxiliary frame structure in a selected position to the main frame structure.

4. A coating device in accordance with claim **3** wherein said clamping means comprise on one of the frame structures cylinder-piston servo means and linkage means coupled to the piston for controlling the position thereof in the cylinder and on the other frame structure retention means engaged with the linkage means in a predetermined position of said piston.

5. An installation for coating bands in continous operation, said installation comprising in combination:

a plurality of coating devices as defined in claim **1**;

a separate enclosure for each of said coating devices; and

an air purifying assembly for each of said enclosures, for removing pollutants released by the coating material and entrained in air, each of said assemblies comprising pump means, burner means for burning combustible pollutants entrained in air, drying means and conduits interconnecting each of said

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enclosures with said pump means, said drying means and said burner means for forcing air flow sequentially through the respective enclosure, burner means and drying means thereby purifying the air and discharge means for discharging the purified air for the enclosures into the atmosphere.

6. An installation in accordance with claim 5 and comprising in each of said assemblies after-burner means interposed between said drying means and discharge means for discharging air into the atmosphere.

7. An installation in accordance with claim 5 wherein said enclosures are disposed in superimposition.

8. An installation in accordance with claim 7 wherein said conduits are disposed in mutually parallel relationship with and between the superimposed enclosures.

9. An installation in accordance with claim 7 and comprising heat-exchanger means for each of said assemblies, each of said heat-exchanger means being included in the respective conduits.

10. A coating device according to claim 1 and comprising second drive means for displacing said coating assembly relative to the auxiliary frame structure and thus relative to the selector roller.

11. A coating device according to claim 1 wherein said guide means on the auxiliary frame structure and on the main frame structure are linear guide means.

* * * * *

14

United States Patent [19]

Preuss et al.

[11] **3,931,791**

[45] **Jan. 13, 1976**

[54] **MECHANISM FOR APPLYING LACQUERS AND THE LIKE ON A PRINTING PRESS**

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[73] Assignee: **Roland Offsetmaschinenfabrik Faber & Schleicher AG**, Germany

[22] Filed: **Sept. 5, 1974**

[21] Appl. No.: **503,475**

[30] **Foreign Application Priority Data**

Sept. 7, 1973 Germany 2345183

[52] U.S. Cl. **118/236**; 118/249; 118/262

[51] **Int. Cl.**^{2} **B05C 1/02**

[58] **Field of Search** 118/262, 46, 236, 239, 118/231, 249, 250; 101/350

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Primary Examiner—John P. McIntosh
Attorney, Agent, or Firm—Wolfe, Hubbard, Leydig, Voit & Osann, Ltd.

[57] **ABSTRACT**

Sheet coating means for a printing press including a back-up cylinder and form cylinder having an associated fountain, the fountain having a fountain roller rotating adjacent the form cylinder. Also rotating adjacent the form cylinder is a first form roller which is coupled to the fountain roller via a dosing roller. The fountain and its associated rollers are mounted upon a subframe having provision for (a) shifting the fountain roller into liquid transmitting contact with the form cylinder and (b) shifting the first form roller into liquid transmitting contact with the form cylinder thereby, selectively, to change the length of the liquid transference path from the fountain to a sheet carried by the back-up cylinder in accordance with the drying speed of the coating material. In a preferred embodiment the fountain assembly includes a second form roller rotating adjacent the back-up cylinder for transmitting coating material directly from the fountain roller to the sheet thereby bypassing the form cylinder, extending the capability to use with coating materials of a viscous nature. Also in a preferred embodiment the fountain roller is driven by means separate from the press drive thereby to control the rate of application.

5 Claims, 4 Drawing Figures

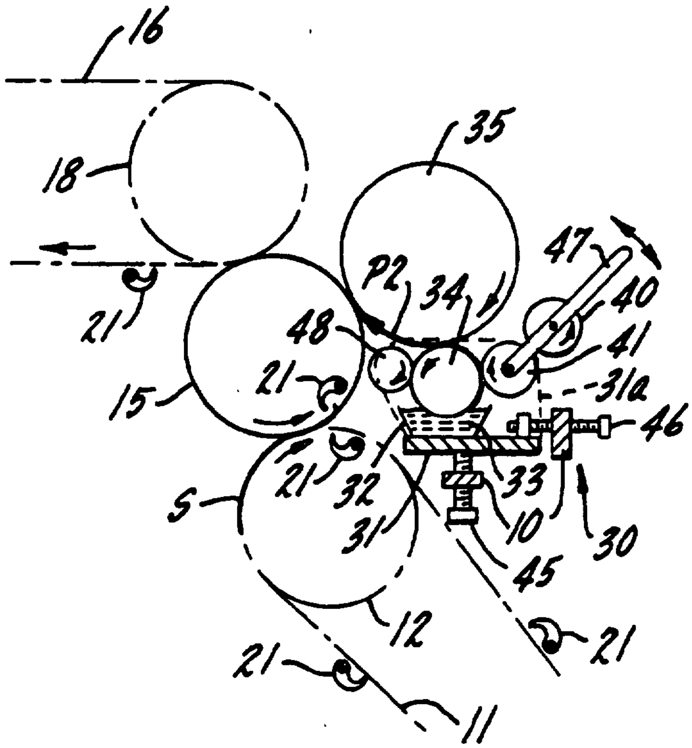


Fig.1.

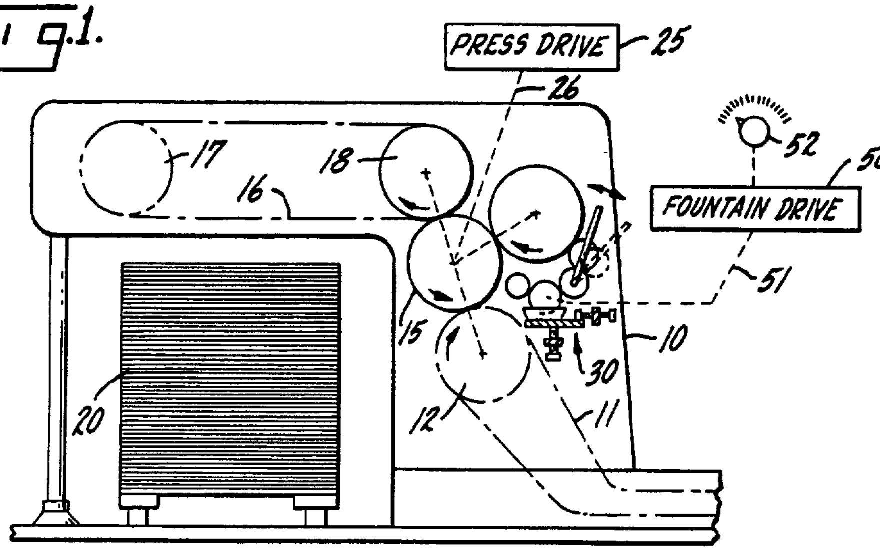
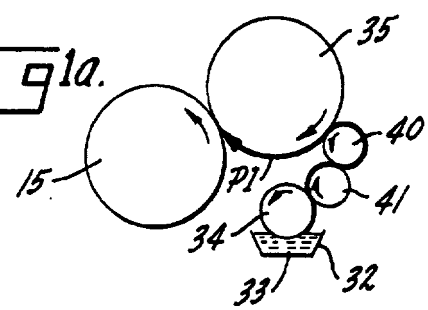


Fig.1a.



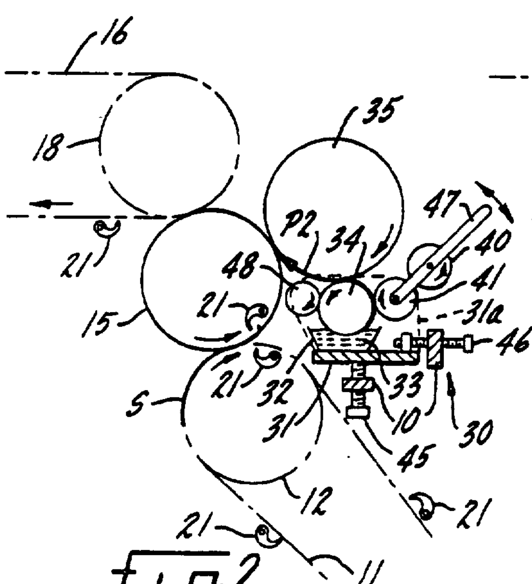


Fig.2.

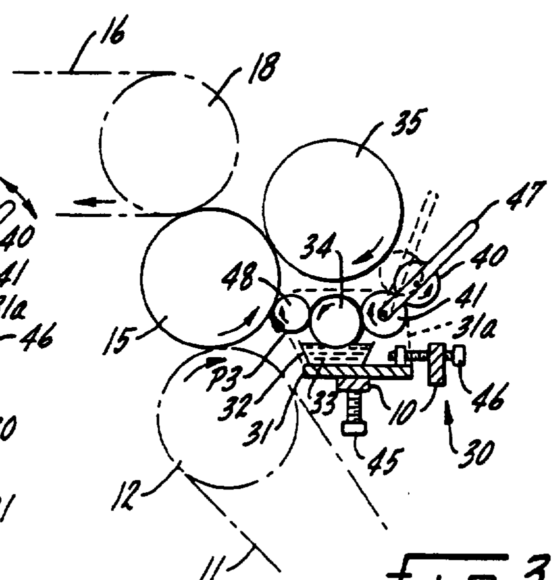


Fig.3.

MECHANISM FOR APPLYING LACQUERS AND THE LIKE ON A PRINTING PRESS

In a sheet fed printing press, particularly of the lithographic type, it is frequently desired to coat a sheet with a liquid coating material, such as a lacquer, after the sheet has been printed and just prior to depositing the sheet on a delivery pile. It is, of course, desirable that the coating material be evenly distributed and applied while it is still in liquid form, before it dries on the rolls. Conventional coating assemblies have been capable of applying relatively slow drying materials, but when employed with fast drying materials the operation has not been successful since the material tends to dry before reaching the sheet. Nor are conventional coaters capable of handling coating materials having a wide range of drying time or wide range of viscosity.

It is, accordingly, an object of the present invention to provide a coating arrangement for use in connection with a lithograph printing press which overcomes the disadvantages of prior coaters and which is highly flexible, being capable of coating with a wide variety of materials having different drying times and different viscosities but which is, nonetheless, simple and economical in construction.

Other objects and advantages of the invention will become apparent upon reading the attached detailed description and upon reference to the drawings in which:

FIG. 1 shows the delivery end of a lithographic printing press including a coating mechanism in accordance with the present invention;

FIG. 1a is a fragmentary diagram showing the fluid path in FIG. 1;

FIG. 2 is a diagram showing the arrangement of FIG. 1 in an alternate mode.

FIG. 3 is a similar diagram showing a still further operating mode.

While the invention has been described in connection with a preferred embodiment, it will be understood that we do not intend to be limited to the embodiment shown but intend, on the contrary, to cover the various alternative and equivalent constructions included within the spirit and scope of the appended claims.

Turning now to FIG. 1 there is shown the delivery end of a printing press having a frame 10 and to which sheets are individually delivered upon a chain type conveyor 11 in which the chains are trained about a pulley 12. From the conveyor 11 sheets are individually passed to a back-up cylinder 15 and thence to a final chain type conveyor 16 having pulleys 17, 18. From the conveyor 16 sheets are deposited in a pile 20. The conveyor 11, cylinder 15 and conveyor 16 have, for simplicity, been shown in diagrammatic form. It will be understood that each of these includes grippers, generally indicated at 21 (FIG. 2) for engaging the leading edge of a printed sheet together with means for synchronously operating the grippers to effect transfer of the sheet from conveyor 11 to cylinder 15, and from cylinder 15 to conveyor 16, from which the sheet is dropped onto the pile. Also for the sake of simplicity the press drive 25 and drive train 26 have been shown diagrammatically, with the understanding that both driving and sheet transfer, from conveyor to cylinder and vice versa, are well understood to those skilled in the art, cross reference being made to the patent literature for the details of construction.

For the purpose of coating a sheet (a typical sheet being indicated at S in FIG. 2) as it is transported on the back-up cylinder 15, a fountain assembly 30 is provided including a subframe 31. Mounted on the subframe is a fountain 32 having a body of liquid coating material 33. Journaled in the subframe, for example, in side plates outlined at 31a, and with its lower surface projecting into the body of coating material, is a fountain roller 34 (see especially FIG. 2). For receiving a film of the coating material from the fountain roller and for transmitting it to a sheet conveyed by the back-up cylinder 15, a form cylinder is provided. Such form cylinder, indicated at 35, is journaled in the press frame 10 and synchronously driven via the drive train 26.

In accordance with the present invention the fountain roller 34 is equipped with a dosing roller and form roller which is engageable with the form cylinder to provide an alternate and longer path of liquid application. Thus we provide, in a position adjacent the form cylinder 35, a form roller 40. Interposed between the form roller 40 and the fountain roller 34, to provide communication between them, is a dosing roller 41. The form roller 40 and dosing roller 41 are both journaled for rotation in the subframe 31 and the subframe is so mounted and constructed, for shifting movement, that the fountain roller 34 and form roller 40 may be selectively engaged with the form cylinder 35. To permit movement of the subframe 31 it is floatingly mounted with respect to the main frame 10, with its position being determined by adjustable shifting means. In the illustrated embodiment shifting of the subframe 31 in the vertical direction is accomplished by an adjusting screw 45 while shifting in the horizontal direction is brought about by an adjusting screw 46, both adjusting screws being threadedly related to the main frame 10. It will be apparent that by unscrewing the adjusting screw 45 the level of the subframe 31 may be dropped to disengage the fountain roller 34 from the surface of the form cylinder 35.

In carrying out the present invention the shifting means preferably includes means for shifting the form roller 40 toward and away from the surface of the form cylinder 35, that is, in the direction of the arrows shown in FIG. 1. To this end the subframe includes a pair of arms 47 (only one of which is shown) which may be pivoted about the axis of the dosing roller 41 and with suitable means (not shown) for holding the arms in a desired operating position.

By manipulation of the shifting means, alternate paths are provided for the costing liquid proportioned in accordance with drying time. Thus referring to FIGS. 1 and 1a, the form roller 40 is advanced into liquid transmitting contact with the surface of the form cylinder 35, while the fountain roller 34 is retracted therefrom, to produce a liquid transference path P1. Such path is lengthy and suited to coating liquids having a relatively long drying time. Indeed, the path is sufficiently long so that volatile elements in the coating material are permitted to escape during the time that the coating material is formed into a smooth film by the action of the rollers 34, 41, 40 and cylinder 35, against one another. Thus when the coating material is transferred onto the sheet at the end of the path P1 it is still in liquid form but it is nonetheless preconditioned for drying after it is deposited upon the surface of the sheet so that the sheets do not stick together upon being deposited on the pile 20.

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Alternatively, the supporting arms 47 (FIG. 2) may be swung away from the form cylinder 35 to retract the form roller 40 from contact, and the adjusting screw 45 may be screwed in to raise the subframe 31 to engage the fountain roller 34 with the surface of the form cylinder thereby to create a short transference path indicated at P2. The path is sufficiently short so that the coating liquid from the fountain is almost immediately applied to the sheet on the back-up cylinder without opportunity for drying to take place on the form cylinder. The mode illustrated in FIG. 2 is, therefore, ideally suited for use with coating liquids having a short drying time.

It will be noted that the rollers, and cylinder 35, are compatible in both of the modes of operation. Assuming that the form cylinder 35 is resiliently surfaced, the form roller 34 may be hard surfaced and in slightly indenting relation to insure that a smooth film is transferred along the path P2. Further, the dosing roller 41 is resiliently surfaced, and the form roller 40, unlike most conventional form rollers, is hard surfaced, indenting both the dosing roller and form cylinder so that a similar film, in even thickness, is transferred along the path P1. Moreover, it will be noted that the directions of the rollers are, in both modes, completely compatible, with the dosing roller 41 not only preserving the "hard-soft" order of the rollers but causing movement of the form roller surfaace 40 to be in the same direction as the surface of fountain roller 34 as required for alternate engagement. Thus it is a feature of the invention that the direction of the fountain roller is preserved in all operating modes.

In accordance with the preferred embodiment of the present invention an auxiliary, or second, form roller 48 is provided mounted on the subframe 31, interposed between the fountain roller and the back-up cylinder, and selectively engageable with the surface of the latter, so that the coating material from the fountain may be applied directly to the sheet on the back-up cylinder, thus bypassing the surface of the form cylinder 35. Such mode of operation, illustrated in FIG. 3, is especially suited for use with coating materials of a viscous nature, for example, certain viscous varnishes. To achieve the mode of operation shown in FIG. 3 the adjusting screw 45 and arms 47 are retracted, and adjusting screw 46 is advanced to shift the fountain subframe 31 horizontally to bring roller 48 against the surface of the back-up cylinder 15. This provides a transference path P3 which may, depending upon the diameter of the roller 48, be somewhat shorter than the path P2 previously mentioned.

It may be noted that while the assembly of rollers and cylinders discussed above provides three distinct, alternative modes of operation, all of the components in the system are, nevertheless, at all times active. Thus in the mode illustrated in FIG. 1, in which transference occurs via rollers 41, 40, the roller 48, by its continued rotation, performs a smoothing function, and this is also true of the mode shown in FIG. 2. Similarly, while rollers 40 and 41 are inactive in the modes of FIGS. 2 and 3 as far as liquid transference is concerned, such rollers, by their continuous rotation, continue to provide a smoothing function, insuring that the film which is transferred along paths P2, P3 is of an even and consistent nature Thus the coating means, in addition to accommodating different drying times and different viscosities, is eminently usable with liquids that are difficult to spread, in an even film, in coating devices of more conventional design.

In the above discussion it has been assumed that the fountain roller and associated rollers are rotated either as the result of surface friction or by providing a suitable and synchronized drive connection with drive train 26. However, it is one of the features of the present invention that the fountain roller 34 is provided with separate driving means diagrammatically indicated at 50 in FIG. 1 and which includes a fountain drive train 51 with the speed of the drive being capable of separate manual adjustment by means of an adjusting knob 52, reference being made to the art relating to controlled speed drives for the details of construction. By separate control of the speed of rotation of the fountain roller 34, the rate at which the coating liquid is drawn from the fountain and hence the thickness of application to the sheet is under the precise control of the operator, with the difference in surface speed being accommodated by slippage, for example, by slippage at the surface of the fountain roller.

In the exemplary embodiment it will be noted that two separate means have been disclosed for achieving movement of the rollers. Thus the rollers may be mounted for bodily shifting movement with a subframe, such as subframe 31, as in the case of roller 34, or the rollers may be mounted for individual shifting, or swinging movement, as in the case of the roll 40 which is swingable on arms 47. If desired, the second form roller 48 may be swingably mounted in the same way as roller 40 for individual movement into and out of engagement with the back-up cylinder. Also if desired the form roller 34 may be individually mounted for movement vertically from the directly transferring position shown in FIG. 2 downwardly, accompanied by deeper submergence into the fountain, into the position shown in FIG. 3. The term "means for shifting the subframe" as used herein therefore includes the relative shifting of rollers with respect to the subframe. Selection of length of path "in accordance with drying speed" shall mean that a long path corresponds to a relatively slow drying speed and vice-versa.

While adjusting screws have been shown simply to illustrate the principle of operation, one skilled in the art will appreciate that in practice throw-over cams or eccentrics may be substituted to simplify shifting between precise alternate positions. The term fountain includes generally means for furnishing liquid to a fountain roller.

What is claimed is:

1. For use with a sheet-fed printing press, means for applying a liquid coating material to a sheet following the printing thereof which comprises a main frame, a back-up cylinder journaled in the main frame, means including grippers for transferring a sheet to the back-up cylinder for transport thereon and for removing the sheet therefrom for delivery, a form cylinder journaled in the main frame in rolling engagement with the back-up cylinder, means for driving the cylinders and gripper means in unison, a fountain assembly including a fountain for the coating material, a fountain roller rotating therein adjacent the form cylinder, a first form roller adjacent the form cylinder, a dosing roller communicatingly interposed between the fountain roller and the first form roller, and a second form roller interposed between the fountain roller and the back-up cylinder, and means for selectively shifting the fountain roller and form rollers with respect to the main frame to (a)

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bring the fountain roller into exclusive liquid transmitting contact with the form cylinder, to (b) bring the first form roller into exclusive liquid transmitting contact with the form cylinder and to (c) bring the second form roller into exclusive liquid transmitting contact with the back-up cylinder thereby to change the length of the liquid transference path from the fountain to the sheet in accordance with the drying speed of the coating material and to insure evenly distributed liquid application of the coating material to the sheet

2. For use with a sheet-fed printing press, means for applying a liquid coating material to a sheet following the printing thereof which comprises a main frame, a back-up cylinder journaled in the main frame, means including grippers for transferring a sheet to the back-up cylinder for transport thereon and for removing a sheet therefrom for delivery, a form cylinder journaled in the main frame in rolling engagement with the back-up cylinder, means for driving the cylinders and gripper means in unison, a fountain assembly having a sub-frame mounted on the main frame and shiftable with respect to it, the fountain assembly including a fountain for the coating material, a fountain roller rotating therein adjacent the form cylinder, a form roller adjacent the form cylinder, a dosing roller communicatingly interposed between the fountain roller and the form roller, and means for selectively shifting the sub-frame with respect to the main frame into alternative conditions to (a) bring the fountain roller into exclusive liquid transmitting contact with the form cylinder and to (b) bring the form roller into exclusive liquid transmitting contact with the form cylinder thereby to change the length of the liquid transference path from the fountain to the sheet in accordance with the drying speed of the coating material to insure evenly distributed liquid application of the coating material to the sheet.

3. The combination as claimed in claim 2 in which a separate drive independent of the press drive is provided for the fountain roller.

4. The combination as claimed in claim 3 in which the drive is provided with speed adjusting means permitting a surface speed lower than press speed for controlling the rate at which the liquid coating material is fed from the fountain.

5. For use with a sheet-fed printing press, means for applying a liquid coating material to a sheet following the printing thereof which comprises a main frame, a back-up cylinder journaled in the main frame, means including grippers for transferring a sheet to the back-up cylinder for transport thereon and for removing the sheet therefrom for delivery, a form cylinder journaled in the main frame in rolling engagement with the back-up cylinder, means for driving the cylinders and gripper means in unison, a fountain assembly including a fountain for the coating material, a fountain roller rotating therein adjacent the form cylinder, a first form roller adjacent the form cylinder, a dosing roller communicatingly interposed between the fountain roller and the first form roller, and a secoond form roller interposed between the fountain roller and the back-up cylinder, and means for selectively shifting the fountain roller and form rollers with respect to the main frame to (a) bring the fountain roller into exclusive liquid transmitting contact with the form cylinder, to (b) bring the first form roller into exclusive liquid transmitting contact with the form cylinder and to (c) bring the second form roller into exclusive liquid transmitting contact with the back-up cylinder thereby to change the length of the liquid transference path from the fountain to the sheet in accordance with the drying speed of the coating material and to insure evenly distributed liquid application of the coating material to the sheet, the rollers being surfaced to produce an alternating hard-soft liquid transfer sequence and the cylinders being driven without reversal of direction during all three exclusive liquid transmitting modes.

* * * * *

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(51) Int. Cl. 2: **B 41 F 23/06**

(19) BUNDESREPUBLIK DEUTSCHLAND

DEUTSCHES PATENTAMT

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(30) Unionspriorität:

(32) (33) (31) –

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(54) Bezeichnung: Einrichtung zum Aufbringen von Puder auf einen Gegendruckzylinder

(71) Anmelder: Maschinenfabrik Augsburg-Nürnberg AG, 8900 Augsburg

(72) Erfinder: Fischer, Hermann, 8900 Augsburg

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(56) Für die Beurteilung der Patentfähigkeit in Betracht gezogene Druckschriften:

DE-PS	3 67 143
US	26 40 458
US	11 60 892

Patentansprüche:

1. Einrichtung zum ständigen Aufbringen von Puder auf einen Teil der Mantelfläche eines Gegendruckzylinders einer Bogendruckmaschine und zum Abgeben des Puders an die Rückseite des Druckbogens mit einer an einem außerhalb der Bogenführungsbahn für den Druckbogen gelegenen Umfangsbereich des Gegendruckzylinders angeordneten Puderauftragung, dadurch gekennzeichnet, daß der Teil der Mantelfläche des Gegendruckzylinders (25) zur Aufnahme einer gleichmäßig haften bleibenden Puderschicht ausgebildet ist, auf welchen die nicht zu bedruckende Rückseite des Bogens zu liegen kommt.

2. Einrichtung nach Anspruch 1, dadurch gekennzeichnet, daß der Teil der Mantelfläche des Gegendruckzylinders (25) aufgerauht ist.

3. Einrichtung nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß zur Auftragung der Puderschicht eine Duktorwalze (19) ständig in einen Behälter (18) eintaucht und ständig an einer Auftragswalze (20) anliegt und daß eine an der Duktorwalze (19) anliegende Abstreifwalze (21) vorgesehen ist.

4. Einrichtung nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß die Puderauftragung durch eine Sprühanlage erfolgt.

5. Einrichtung nach einem der Ansprüche 1 bis 4, dadurch gekennzeichnet, daß die Puderauftragung taktmäßig schaltbar ist.

6. Einrichtung nach Anspruch 3 oder 5, dadurch gekennzeichnet, daß die Auftragswalze (20) durch eine Kurvensteuerung (22) taktmäßig von dem Gegendruckzylinder (25) abhebbar ist.

Die Erfindung bezieht sich auf eine Einrichtung zum ständigen Aufbringen von Puder auf einen Teil der Mantelfläche eines Gegendruckzylinders einer Bogendruckmaschine und zum Abgeben des Puders an die Rückseite des Druckbogens mit einer an einem außerhalb der Bogenführungsbahn für den Druckbogen gelegenen Umfangsbereich des Gegendruckzylinders angeordneten Puderauftragung.

Eine derartige Einrichtung ist aus der US-PS 11 60 892 bekannt. Sie dient dazu, in einer Druckmaschine für Schön- und Widerdruck nach dem Aufbringen des Widerdruckes auf einen kurz zuvor in einem anderen Druckwerk mit dem Schöndruck versehenen Druckbogen die von dem noch frischen Schöndruck auf die Mantelfläche des Gegendruckzylinders unvermeidlich abgegebene Farbe wieder zu entfernen, bevor der nächste Druckbogen zugeführt wird. Hierzu ist unmittelbar hinter der Auftragsvorrichtung für den Puder eine Bürst- und Absaugvorrichtung angeordnet, mit deren Hilfe die am Gegendruckzylinder anhaftende Farbe abgebürstet, mit dem aufgetragenen Puder vermengt und abgesaugt wird, um sicherzustellen, daß weder Farbe, noch Puder an dem Gegendruckzylinder haften bleibt.

Mit dieser bekannten Einrichtung kann somit nur ein sogenanntes Abschmieren, d. h. Abfärben des frischen Druckes auf den folgenden Druckbogen, innerhalb des Druckwerkes selbst verhindert werden. Es tritt aber sehr häufig auch der Fall auf, daß der Druck noch im Auslegestapel abschmiert, was durch die bekannte Einrichtung nicht vermieden werden kann.

Um das Abschmieren im Auslegestapel zu verhindern, ist es üblich, über dem Auslegestapel eine gesteuerte Sprüheinrichtung anzuordnen, die Puder mit Hilfe von Druckluft auf die frisch bedruckte Seite des jeweils obersten Druckbogens steuert. Aus der US-PS 26 40 458 ist es auch bekannt, auf einem gesonderten Druckmaschinenzylinder Puder auf den frischen Druck aufzutragen. Beides hat jedoch den Nachteil, daß durch das unmittelbare Auftragen des mehligen Puders auf den frischen Druck dem Druckbild der Glanz der frischen Farbe genommen wird.

Der Erfindung liegt nun demgegenüber die Aufgabe zugrunde, eine Einrichtung zum Aufbringen von Puder auf einen Gegendruckzylinder der eingangs genannten Art zu schaffen, mit welcher ein Abschmieren im Auslegestapel vermieden werden kann, ohne daß das Aussehen des Druckbildes darunter leidet.

Diese Aufgabe wird erfindungsgemäß dadurch gelöst, daß der Teil der Mantelfläche des Gegendruckzylinders zur Aufnahme einer gleichmäßig haften bleibenden Puderschicht ausgebildet ist, auf welchen die nicht zu bedruckende Rückseite des Bogens zu liegen kommt.

Diese Einrichtung hat den Vorteil, daß der Puder nicht auf die frisch bedruckte Vorderseite des Druckbogens, sondern auf die unbedruckte oder ggf. in einem früheren Arbeitsgang bedruckte Rückseite des Druckbogens aufgebracht wird. Sie ermöglicht das Aufbringen einer fein dosierten Puderschicht, so daß in dem Auslegestapel weit weniger Puder auf den frisch bedruckten Bogenoberseiten abgesetzt wird. Diese Einrichtung hat den weiteren Vorteil, daß der Puder beim eigentlichen Druckvorgang gleichsam in die Rückseite der Druckbogen eingewalzt wird, so daß er dort auch während des Transportes der Druckbogen zum Auslegestapel sicher haften bleibt.

Weitere Ausgestaltungen der Erfindung ergeben sich aus den Unteransprüchen. Im folgenden wird die Erfindung anhand eines in der Zeichnung dargestellten Ausführungsbeispieles näher erläutert. Es zeigt

Fig. 1 eine Offset-Bogendruckmaschine in Reihenbauart mit drei Druckwerken schematisch,

Fig. 2 das letzte Druckwerk schematisch in größerem Maßstab.

Die zu bedruckenden Bogen werden in bekannter Weise vom Stapel 1 über den Anlegetisch 2 mittels eines sogenannten Schwinggreifers 3 an die Anlegetrommel 4 übergeben, von welcher sie von den Greifern des Gegen-Druckzylinders 5 des Druckwerks I übernommen werden. Jedes Druckwerk weist in üblicher Weise außer dem Gegen-Druckzylinder 5 bzw. 25 einen Gummizylinder 6 bzw. 26 und einen Plattenzylinder 7 bzw. 27 auf, dem ein Farbwerk 8 bzw. 28 und ein Feuchtwerk 9 bzw. 29 zugeordnet sind. Die Druckwerke II und III sind untereinander durch eine 10 oder mehrere Überführtrommeln 11, 12, 13 miteinander verbunden. Nach dem letzten Druckwerk III übernimmt eine mit der Auslegetrommel 14 zusammenwirkende Greifereinrichtung an endlosen Auslegeketten 15 die Bogen zur Ablage auf den Stapel 16.

Um das direkte Einwirken des pulverförmigen Puders auf die frische Farbe am Auslegestapel zu verhindern, ist am letzten Druckwerk eine Auftragvorrichtung 17 für die Aufbringung des Mittels auf die Bogenrückseite vorgesehen. Diese Vorrichtung 17 besteht aus einem den Puder enthaltenden Behälter 18, in welchem eine Duktorwalze 19 umläuft, gegen die eine Auftragwalze

20 anliegt, die ihrerseits taktmäßig an die Mantelflache des Gegen-Druckzylinders 25 anstellbar ist. Eine eine rauhe Oberfläche aufweisende Abstreifwalze 21 ermöglicht die Regulierung der von der Duktorwalze 19 zur Auftragwalze 20 geförderten Menge des Puders. Die Vorrichtung 17 ist als leicht in die Maschine im Bedarfsfall einsetzbare Baueinheit ausgebildet. Die Lagerung der Auftragwalze 20 erfolgt dabei so, daß beispielsweise durch eine Kurvensteuerung 22 an beiden Enden, die Auftragwalze 20 nur über die Länge des Druckträgers am Gegen-Druckzylinder 5 anliegt und über den restlichen Umfang desselben abgestellt ist.

Gegebenenfalls kann auch die Länge der Auftragwalze auf die Breite des Druckträgers abgestimmt sein.

Anstelle der beschriebenen Auftragung durch ein Walzenwerk kann die Behandlung der Druckzylindermantelfläche auch durch eine Sprühanlage mit taktmäßiger Steuerung eines Ventils in der Druckleitung des Behandlungsmittels erfolgen.

Es ist durchaus denkbar, daß auch an den Druckzylindern der dazwischenliegenden Druckwerke, wie bei 17' angedeutet ist, Vorrichtungen der beschriebenen Art zur Behandlung der Bogen vorgesehen sein können.

Hierzu 1 Blatt Zeichnungen

Nummer. 21 51 185
Int. Cl.². B 41 F 23/06
Bekanntmachungstag. 19. Juli 1979

Fig. 1

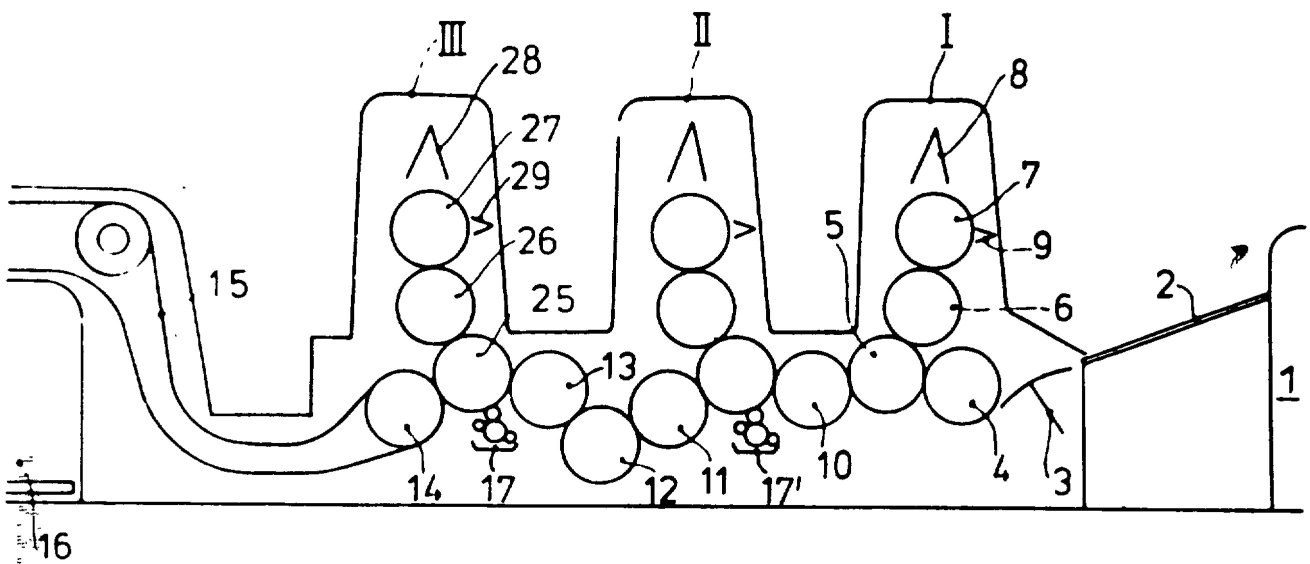
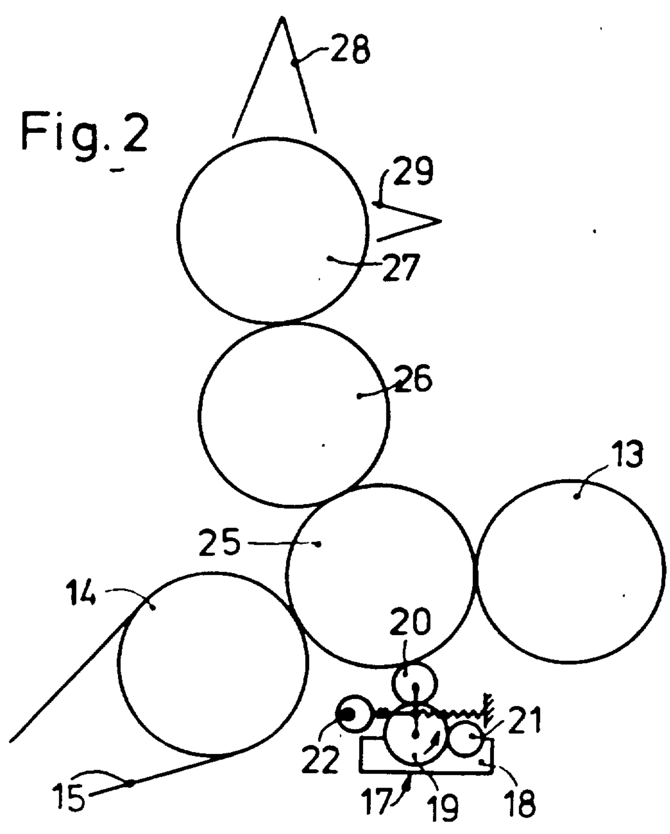


Fig. 2



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United States Patent [19]

Leanna et al.

[11] **4,165,688**

[45] **Aug. 28, 1979**

[54] **INK DAM FOR PRINTING PRESS**

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[73] Assignee: **Magna-Graphics Corporation**, Oconto Falls, Wis.

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Related U.S. Application Data

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[51] **Int. Cl.**[2] **B41F 31/06**

[52] **U.S. Cl.** **101/207**; 101/210; 101/363

[58] **Field of Search** 101/205, 206, 207, 208, 101/210, 350, 363, 364, 366, 148; 118/258, 259, 407

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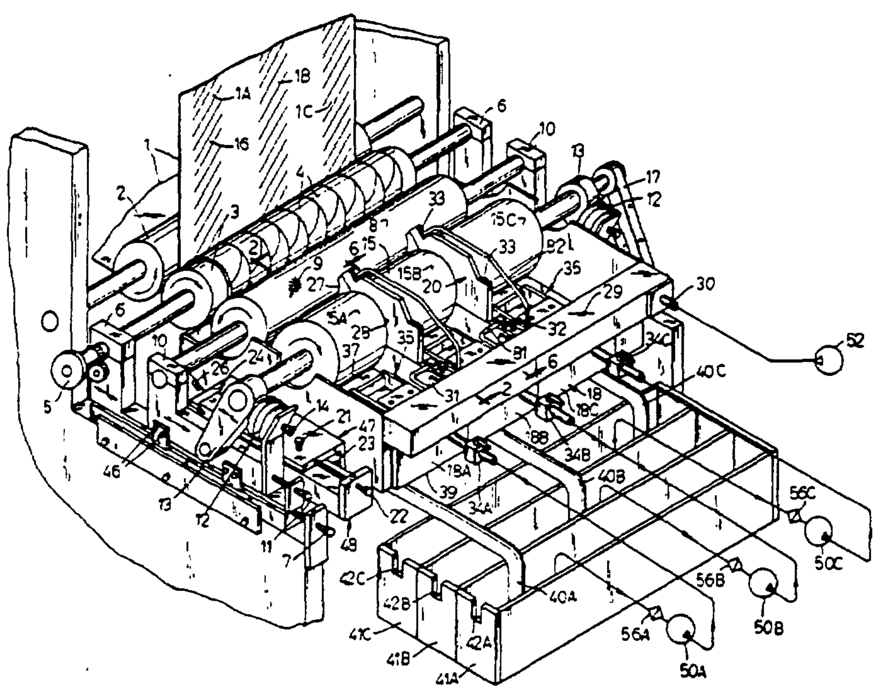
Primary Examiner—J. Reed Fisher
Attorney, Agent, or Firm—James E. Nilles

[57] **ABSTRACT**

A printing press ink fountain has means for applying different colored inks to different sections of a circumferentially grooved fountain roll for subsequent transfer to an anilox roll, printing cylinder, and moving web. Ink dams or dividers, each having a hole through which the fountain roll extends, divide the ink fountain into separate ink compartments and cooperate with the fountain and anilox rolls to prevent ink transfer between adjacent sections on each roll. Each divider has a circumferential edge around its hole which extends into a fountain roll groove. Each divider also has a grooved edge which rides against the anilox roll. Air ports are provided along these edges and compressed air is expelled therethrough to provide air seals to prevent ink transfer along the rolls. A resilient hollow pneumatically operated tube between the bottom of each divider and the ink fountain provides a mechanical seal between adjacent ink fountain compartments and also biases the grooved edge of the divider against the anilox roll in a tight mechanical seal.

7 Claims, 9 Drawing Figures



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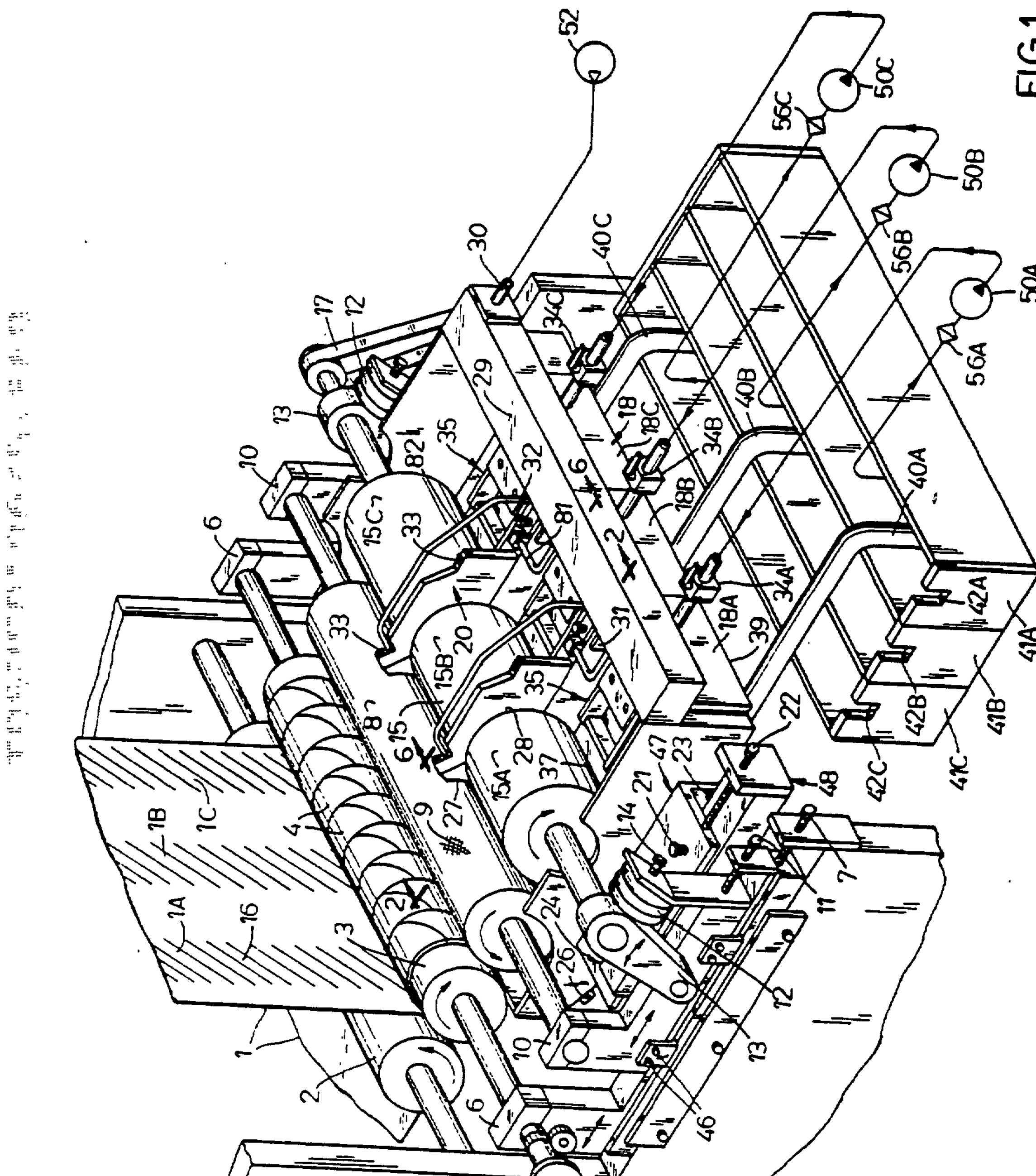
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41A
41B
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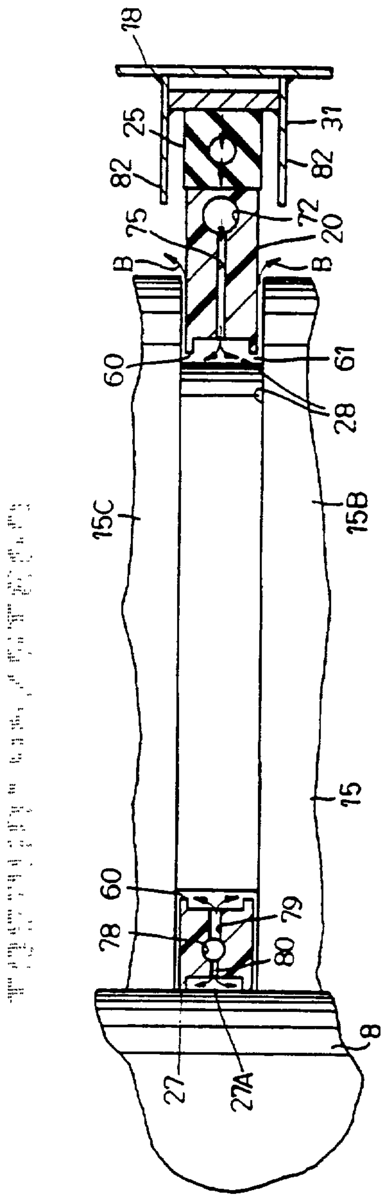
56C
81
82

FIG.1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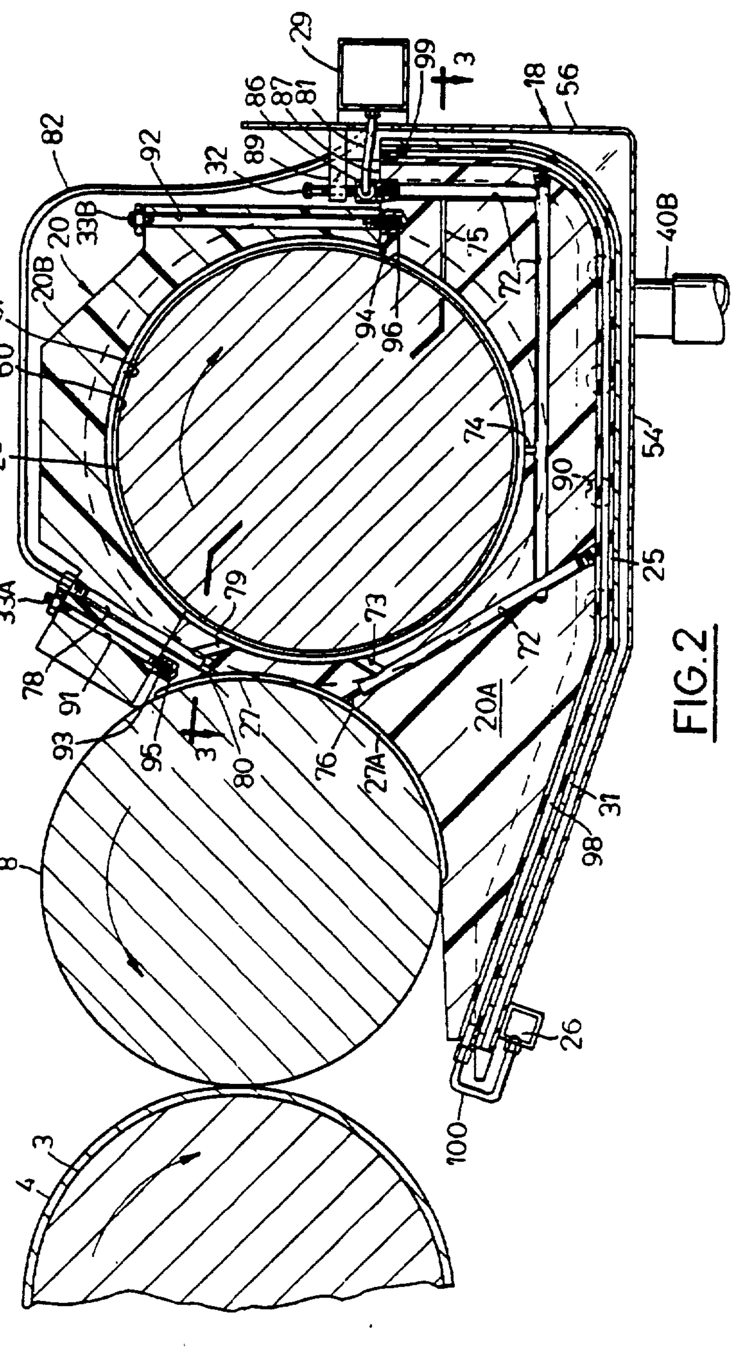
27A
8

FIG. 3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91
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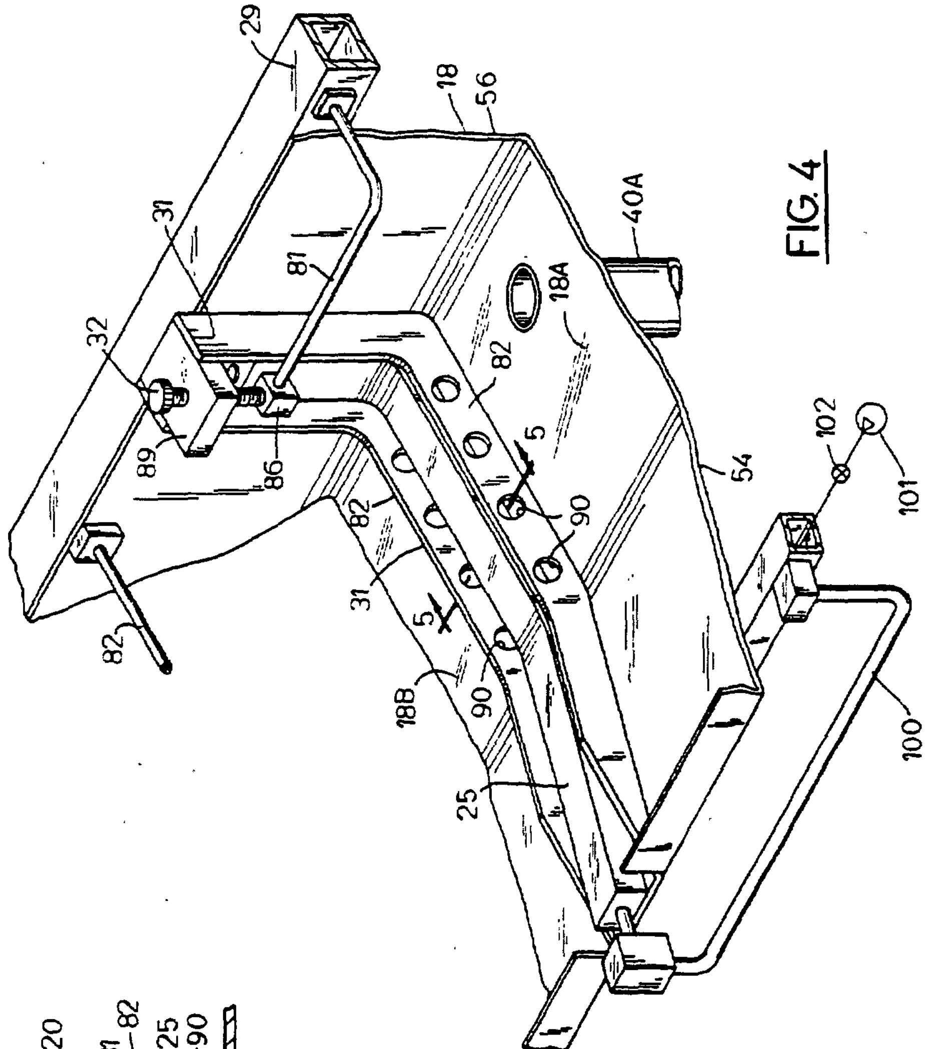
3

FIG. 2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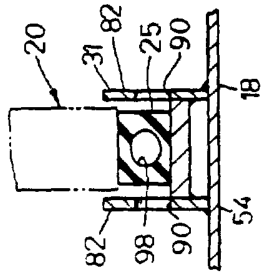
100

FIG. 4


20
31
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18
82
98
90
54

FIG. 5

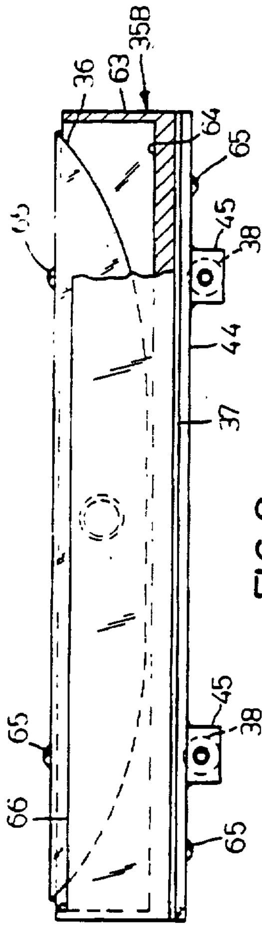


FIG.8

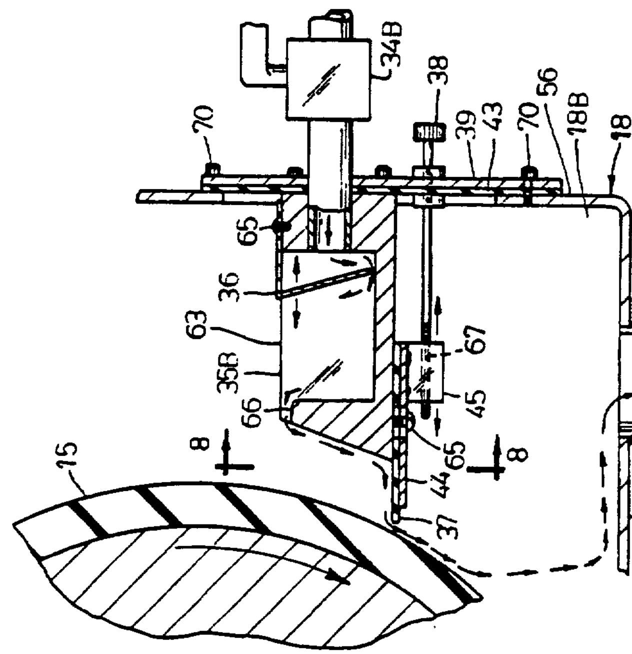


FIG.7

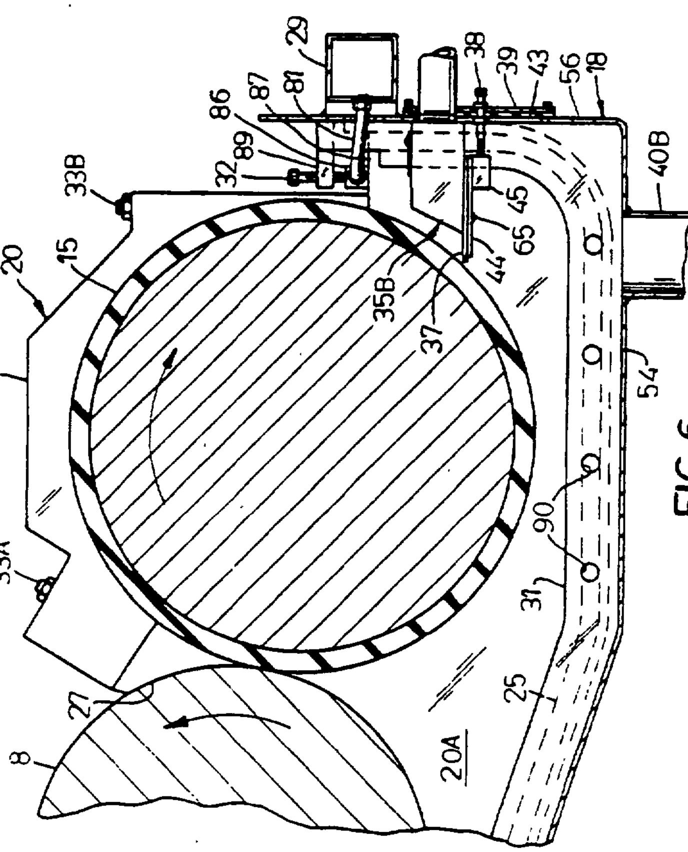
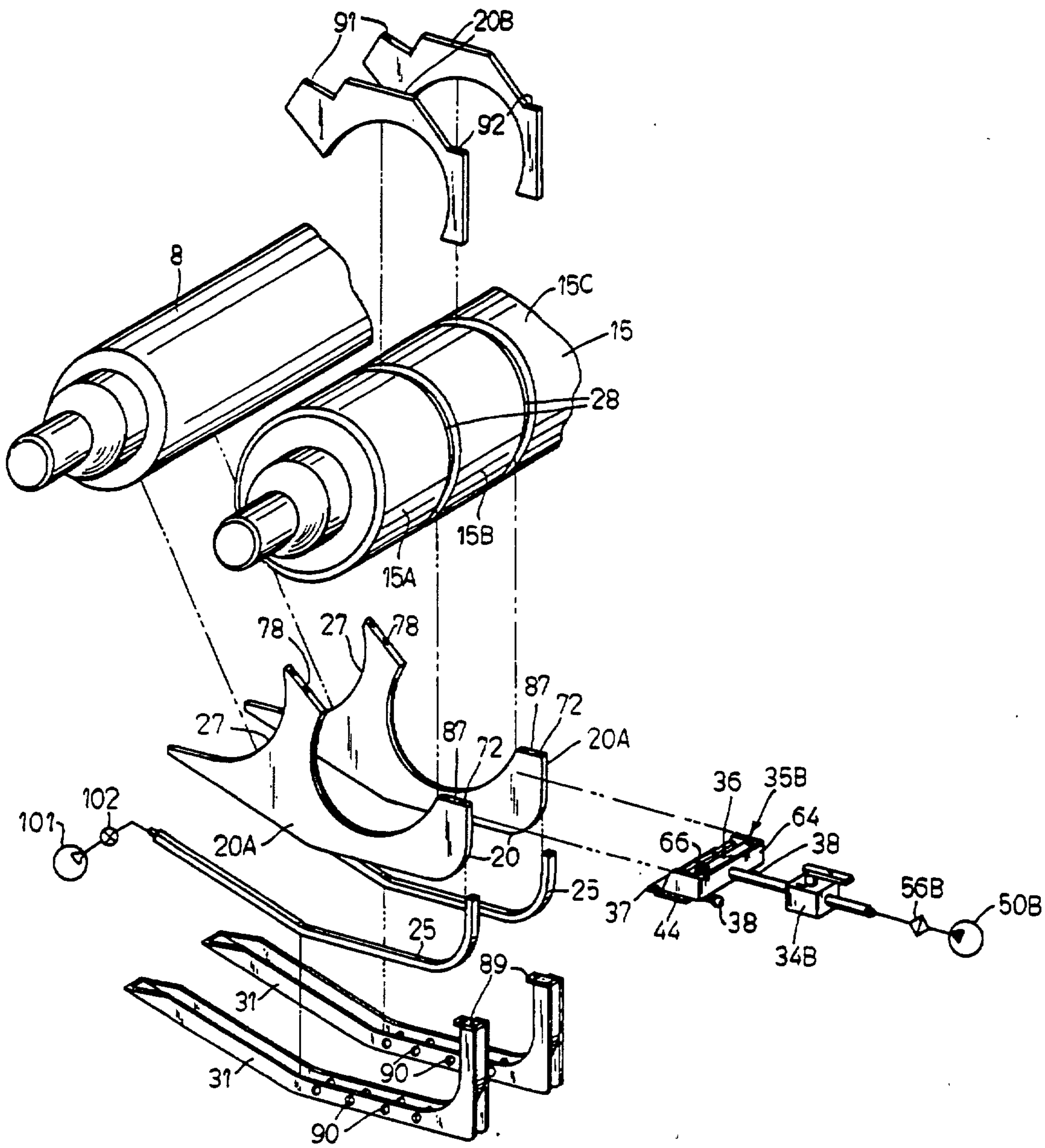


FIG.6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101
102
64
66
38
20A
20
25
37
44
38
56B
50B
25
34B
89
31
90
31
90

FIG. 9

INK DAM FOR PRINTING PRESS

REFERENCE TO RELATED CO-PENDING APPLICATION

This application is a continuation of patent application Ser. No. 787,434, filed Apr. 14, 1977 and now abandoned.

BACKGROUND OF THE INVENTION

1. Field of Use

This invention relates generally to ink dams for printing presses. In particular, it relates to a flexographic multicolor printing press wherein the ink fountain has means for applying different colored inks to different sections of a circumferentially grooved fountain roll for subsequent transfer to an anilox roll, printing cylinder, and moving web and wherein ink dams or dividers, each having a hole through which the fountain roll extends, divide the ink fountain into separate ink compartments and cooperate with the fountain and anilox rolls to prevent ink transfer between adjacent sections on each roll.

2. Description of the Prior Art

Some flexographic printing presses include an ink fountain having means to apply ink to a fountain roll for subsequent transfer to an anilox roll, printing cylinder, and moving web. Typically, the ink fountain extends substantially the entire length of the rolls in the press. If it is desired to print using inks of different colors across the web, or to print on a web which is narrower than the length of the ink fountain, it is the practice to divide the fountain into separate compartments by means of ink dams or dividers which are constructed so as to divide the fountain into separate compartments, to maintain a fluid-tight seal between compartments in the fountain, and to maintain a seal against the fountain roll. The prior art contains numerous examples of such dividers and the following U.S. Pat. Nos. illustrate the state of the art: 3,831,517; 3,635,161; 2,887,050; 2,525,363; and 2,442,700.

In some prior art arrangements, the ink dam or divider has edges confronting the fountain roll and the floor of the ink fountain pan and resilient sealing means are disposed along the edge confronting the fountain roll to form a seal. One of the difficulties with such prior art arrangements is that the friction between the fountain roll and the sealing means eventually results in wearing down of the sealing means thereby allowing ink to leak past the sealing means thereby contaminating ink in an adjacent compartment or allowing ink to be applied to a section of the roll whereat it is not desired. This problem is aggravated in certain industries where inks of very low viscosity, almost as thin as water, are employed. Prior art attempts to overcome this problem have not always been successful, and consequently, it is necessary in some industries to avoid the problem entirely by turning to different methods of producing printed material.

For example, in the manufacture of paper toweling, it has heretofore been the practice to imprint a relatively wide web of material (on the order of eight to ten feet wide) in a flexographic printing press which applies spaced apart bands or designs of the same color on the web and then to subsequently split the web and form separate rolls of paper toweling each having the same color imprinted thereon. A separate press (or the same press set up for a different colored ink) is then used to produce rolls of paper toweling of other colors. Manual labor is then employed to select rolls of different colors and pack them in a shipping container whereby the purchaser has a selection of different colored rolls available. This procedure is time-consuming and costly.

SUMMARY OF THE INVENTION

In accordance with the present invention, there is provided a flexographic multicolor printing press for applying patterns or images of different colored inks to a continuously moving web. The printing press ink fountain has means for applying different colored inks to different sections of a circumferentially grooved fountain roll for subsequent transfer to an anilox roll, printing cylinder, and moving web. Ink dams or dividers, each having a hole through which the fountain roll extends, divide the ink fountain into separate ink compartments and cooperate with the fountain and anilox rolls to prevent ink transfer between adjacent sections on each roll. Each divider has a circumferential edge around its hole which extends into a fountain roll groove. Each divider also has a grooved edge which rides against the anilox roll. Air ports are provided along these edges and compressed air is expelled therethrough to provide air seals to prevent ink transfer along the rolls. A resilient hollow pneumatically operated tube between the bottom of each divider and the ink fountain provides a mechanical seal between adjacent ink fountain compartments and also biases the grooved edge of the divider against the anilox roll in a tight mechanical seal. Means are provided to effect slight separation between the fountain roll and the anilox roll when the press is in non-printing condition and the pneumatically operated tube operates to maintain the seal between the divider and the anilox roll during this condition. Means are also provided to enable the anilox roll, the fountain roll, the ink fountain, and the ink dam assembly to be moved together as a unit toward and away from the plate cylinder.

A flexographic multicolor printing press having ink dams in accordance with the invention offers several advantages over prior art arrangements. For example, the press may be employed to simultaneously apply several different colors at the same time without danger of one color of ink from flowing from one compartment of the ink fountain to another, or from travelling between one section of the fountain roll to another, or from travelling between one section of the anilox roll to another. Furthermore, each divider has a circumferential edge which extends into a groove in the fountain roll and compressed air admitted into the groove through holes along the circumferential edge effectively isolates one section of the fountain roll from an adjacent section even though there is no mechanical contact or frictional engagement between the divider and fountain roll, as is the case in many prior art arrangements. Similarly, each divider cooperates with the anilox roll in such a manner that there is both a mechanical seal and a compressed air seal between the grooved edge of the divider and the surface of the anilox roll, instead of merely a mechanical seal as in prior art arrangements. The holes in the divider which direct air into the groove in the fountain roll and against the anilox roll are so proportioned sizewise with respect to each other that a uniform air pressure is maintained in the groove around the fountain roll and along a portion of the anilox roll. Furthermore, the arrangement is such

as to enable air pressure in the groove to be relatively low thereby reducing overall power requirements in the operation of the press. In addition, each divider is provided with a compressed air-operated sealing means in the form of a pneumatic tube which not only effectively seals one compartment of the ink fountain from another, but enables the divider to self-adjust in its engagement with the anilox roll when the fountain roll and anilox roll are separated or as wear occurs along the grooved edge where the divider meets the surface of the anilox roll. The ink fountain and ink nozzles employed in the present invention apply ink to the fountain roll so that the fountain roll is effectively coated with ink and yet there is no surplus amount of ink in the fountain itself.

The dividers in accordance with the invention, in addition to effectively maintaining a division between inks of different colors, can be used as end dams either in single or multicolor printing operations. Apparatus in accordance with the invention is especially useful in presses which use ink of very low viscosity and can maintain an effective seal under such conditions. Also, because compressed air is used as the seal for the rubber covered fountain roll, instead of mechanical sealing means which rely principally on frictional engagement between components, wear on components and possible damage to the fountain roll is reduced to a minimum and, therefore, replacement of parts and downtime is substantially reduced. The apparatus in accordance with the invention is so constructed that it can be economically manufactured and installed and quickly and easily assembled and disassembled, as required. Other objects and advantages of the invention will hereinafter appear.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a flexographic multicolor printing press having ink dams or dividers in accordance with the present invention;

FIG. 2 is an enlarged cross-sectional view taken on line 2—2 of FIG. 1;

FIG. 3 is an enlarged view, partly in cross section, taken on line 3—3 of FIG. 2;

FIG. 4 is an enlarged perspective view of a portion of the ink fountain showing the self-adjusting pneumatic sealing means for the divider;

FIG. 5 is an enlarged cross-section view taken on line 5—5 of FIG. 4;

FIG. 6 is an enlarged view, partly in cross section, generally along line 6—6 of FIG. 1;

FIG. 7 is an enlarged cross-sectional view of the ink nozzle assembly shown in FIG. 6;

FIG. 8 is an elevational view taken on line 8—8 of FIG. 7; and

FIG. 9 is an exploded view of the fountain roll, anilox roll, dividers, pneumatic sealing means, and ink nozzle shown in FIGS. 1, 2, 3, and 4.

DESCRIPTION OF A PREFERRED EMBODIMENT GENERAL ARRANGEMENT

FIG. 1 shows a portion of a flexographic multicolor printing press in accordance with the invention for imprinting a web 1 with a plurality of bands or patterns of different colored inks, the bands being designated 1A, 1B, and 1C. Web 1 passes between a stationarily mounted rotatable impression cylinder or roll 2 and a printing cylinder or plate roll 3 which has a plurality of printing plates 4 mounted on its periphery. The plates 4 receive ink from an anilox roll 8 which has many minute ink-carrying pockets 9 of different sizes and shapes on the surface thereof for carrying inks of different viscosities. Anilox roll 8 is inked by means of a rubber covered fountain roll 15 which is provided with a pair of spaced apart grooves 28 which divide the roll into three sections 15A, 15B, and 15C. During printing operation, the rolls 2, 3, 8, and 15 are in contact and are driven by means of a suitable conventional drive mechanism (not shown). During a non-printing operation, the plate roll 3 and anilox roll 8 are separated and fountain roll 15 is driven by means of a Sunday drive mechanism 17, including a drive belt 17A and a pulley 17B attached to one end thereof, which automatically comes into play to keep the fountain roll 15 and anilox roll 8 rotating to prevent ink drying. Furthermore, the anilox roll 8 and the fountain roll 15 can be separated during a non-printing operation.

Means are provided, as hereinafter described, for rotatably mounting and for adjusting the positions of rolls 3, 8, and 15.

The press comprises an ink fountain 18 above which the fountain roll 15 and the anilox roll 8 are located. Means are provided to divide the ink fountain 18 into three separate sealed compartments 18A, 18B, and 18C, each for a different colored ink, and for keeping separate the inks which are applied to fountain roll 15 and anilox roll 8. Such means include a pair of spaced apart ink dams or dividers 20 which are mounted on ink fountain 18 and cooperate with the grooves 28 in fountain roll 15 and with the anilox roll 8 as hereinafter explained.

Means are provided to supply a different colored ink to each of the three sections 15A, 15B, and 15C of the fountain roll 15 and comprise ink nozzles 35A, 35B, and 35C, respectively, which are supplied with ink through shut-off valves 34A, 34B, and 34C by means of ink pumps 50A, 50B, and 50C, respectively. The compartments 18A, 18B, and 18C of the ink fountain 18 are connected by drains 40A, 40B, and 40C, respectively, to separate ink reservoirs 41A, 41B, and 41C, respectively, and the latter are connected to the ink pumps 50A, 50B, and 50C, respectively, which return the inks through the ink nozzles 35A, 35B, and 35C, respectively.

As FIG. 9 shows, each groove 28 on the fountain roll 15 is associated with and accommodates a divider 20. Each divider 20 comprises a lower section 20A and an upper section 20B and each is provided with internal air passages, hereinafter described, to which air is supplied by means of an air pump 52 and an air manifold 29. Some air passages in divider 20 discharge compressed air into groove 28 in fountain roll 15 to prevent ink transfer between adjacent sections 15A, 15B, 15C of the roll as hereinafter explained. Other air pasages in divider 20 discharge air against a portion of the anilox roll 8 to prevent ink transfer from one section to another therealong, as hereinafter explained.

Each divider 20 is provided along its bottom edge with a compressed air actuated self-adjusting sealing means 25 which is supplied with compressed air from an air manifold 26, shown in FIG. 2, which is supplied from an air pump 54.

PRESS ROLL SUPPORTS, ADJUSTMENT MEANS AND DRIVE MEANS

As FIG. 1 shows, printing cylinder 3 has alignment means 5 on one end thereof and is mounted for rotation on a pair of sliding bearing mounting rails 6, which are air operated and which are provided with manually

adjustable stops 7 for making minute settings or adjustments between the impression roll 2 and the printing cylinder 3. The anilox roll 8 is rotatably mounted on sliding bearing mounting rails 10 which are air operated and which have manual adjustment stops 11 for making minute settings or adjustments between the anilox roll 8 and the printing cylinder 3. The sliding bearing mounting rails 10 are associated with a pair of air-operated pivotally movable fountain roll brackets 13 which support fountain roll 15. The brackets 13 are movable by means of air-operated bellows 12. Manual adjustment stops 14 are provided to adjust the bellows 12 and thereby effect minute settings or adjustments between the fountain roll 15 and the anilox roll 8.

It is to be understood that the rolls 2, 3, 8, and 15 are driven by a suitable conventional press drive mechanism (not shown). When the press is ready for a printing operation, all rolls 2, 3, 8, and 15 are in contact and the printing plates 4 on roll 3 receive and transfer ink from the anilox roll 8 to web 1. When the press is in the non-printing condition, the anilox roll 8 is moved by means of the rails 10 out of engagement with the plates 4 on roll 3, but the anilox roll 8 still maintains contact with fountain roll 15 so that any ink in the pockets 9 on anilox roll 8 will not dry and harden. The drive mechanism (not shown) normally drives the press at web speeds of above 75 feet per minute. However, when web speed drops to approximately 75 feet per minute, Sunday drive mechanism 17 automatically comes into play and keeps fountain roll 15 and anilox roll 8 rotating even though the printing press comes to a stop. Such rotation prevents the ink at pockets 9 on anilox roll 8 from hardening since fresh ink is being applied thereto. As this occurs (i.e., as the press stops), the printing cylinder 3 makes four to five final revolutions in order to dry off the printing plates 4 on the web 1. After these final revolutions are completed, the plate roll 3 is moved automatically by movement of its mounting rails 6 away from web 1 and impression cylinder 2.

THE INK FOUNTAIN

As FIGS. 1, 2, 4, and 6 show, ink fountain 18 includes an ink pan 54 above which the fountain roll 15 and the anilox roll 8 are located. Ink pan 54 is closed at its end by end walls 56 and is divided into three separate compartments 18A, 18B, and 18C by the pair of dividers 20. Each divider 20 is supported in a bracket member 31 which has a U-shaped or channel-shaped cross section and which is welded to pan 54 at a desired location. Each bracket 31 also serves to support a pneumatic seal 25 as hereinafter explained. The ink fountain 18 is mounted on the anilox bearing slide rails 10 by bolts 46 which also secure it to the fountain roll mounting rails 47 and 48. This arrangement enables the dividers 20 and the anilox roll 8 to remain in a predetermined relationship with each other. This relationship can be adjusted by means of adjusting screws 21, which control the vertical setting, by means of adjustment screws 22, which control the horizontal setting, and by means of adjustment screws 23, which control the lateral or axial setting. After the components are properly adjusted or set, the fountain roll mounting rails 47 and 48 are secured or clamped together by means of clamps 24.

Each compartment 18A, 18B, 18C of ink fountain 18 is provided with a drain pipe 40A, 40B, 40C, respectively, which connects with a reservoir 41A, 41B, 41C. The drains 40A, 40B, 40C are of such a size that never more than about one-half inch of ink can collect in a section of the pan.

The ink fountain 18 is so designed and constructed as to be easily removable from the press. For example, the top section 20B of the dividers 20 is first removed, as hereinafter explained, and then the fountain roll 15 can be removed. When the drains 40A, 40B, 40C are disconnected, the ink fountain 18 can then be slid outward on the rails 47 and 48 without removing the lower portions 20A of the dividers 20 and with the rubber air seals 25 intact and without removing the anilox roll 8. Once ink fountain 18 is withdrawn, easy replacement of the seals 25, the bottom sections 20A of the dividers 20 and other components is possible. The ink fountain 18, including the ink pan 54, the dividers 20, and the seals 25 are then slid back into the predetermined position determined by the setting of the adjusting screws 21, 22, and 23 and reclamped into place by means of clamps 24. The fountain roll 15 and the top sections 20B of the dividers 20 are then set into place and the press is ready for a printing operation. The dividers 20 are so designed and constructed that the fountain roll 15 can be disengaged from the anilox roll 8 while the settings of the dividers 20 and the settings of the anilox roll 8 are still maintained. As hereinafter explained, the edge 27 of each divider 20 contacts the anilox roll 8 and this edge is also provided with an air flow groove 27A. Futhermore, each divider 20 also has an inner edge 60 around a circular opening 61 which accommodates the fountain roll 15 and the edge 60 extends into a circumferential groove 28 in the fountain roll. However, the edge 60 does not frictionally engage the sides or the bottom of the groove 28 and there is a loose fit for passage of air, as hereinafter explained.

THE INK SUPPLY

Referring now to FIGS. 1, 4, 6, 7, and 8, the ink nozzles 35 A, 35B, and 35C are similar, and each supplies ink to a section 15A, 15B, 15C, respecitvely, of fountain roll 15. Nozzle 35B, for example, includes a member 63 having a trough 64 therein. An adjustable ink deflector 36 is secured by screws 65 and depends into the trough 64 so as to provide an even ink flow during filling of the trough. The discharge side 66 of member 63 is bevelled and ink overflowing from the trough 64 descends by gravity onto a flat rubber deflector 37 which is secured to the underside of member 63 by a back-up stiffener plate 44 and screws 65. Stiffener plate 44 and deflector 37 attached thereto is horizontally adjustable with respect to fountain roll 15 by means of adjusting screws 38 which extend into threaded holes 67 in an adjusting block 45 secured on the underside of plate 44. The block 45, plate 44, and deflector 37 are all movable together as a unit with respect to member 63 and roll 15. Deflector 37 is made of rubber so as not to damage the rubber covering of fountain roll 15 when the latter is in the non-printing position, i.e., when it is moved rightward with respect to FIG. 7. Member 63 of nozzle 35B is mounted on a door plate 39 which is secured to the side 56 of pan 54 by means of screws 70. A seal gasket 43 is disposed between the door 39 and the pan 54. Nozzle 35B can be independently adjusted in a vertical direction or, if necessary, entirely removed from the ink fountain 18 by loosening or removing screws 70. As hereinbefore explained, ink is pumped by pump 50B from reservoir 41B and through filter system 56B, through manual shut-off control valve 34B, and into trough 64 in ink nozzle 35B.

Ink is supplied to the fountain roll 15 in such quantities and at such a rate that the fountain roll 15 does not run in a flooded condition. More specifically, drain 40B in compartment 18B is of such a size as to maintain rapid drainage from the ink pan 54. The return reservoir 41B to which the drain 40B is connected has its own ink overflow drain 42B so as to prevent overflow and intermixing of the different colored inks in the reservoirs 41A, 41B, and 41C.

THE DIVIDERS

Referring to FIGS. 1, 2, 3, 4, and 9, each divider 20 is fabricated of high molecular plastic which is mechanically strong, ink and chemical resistant, and has a low coefficient of friction. Each divider 20 comprises a lower section 20A and upper section 20B which are rigidly secured together by means of two bolts 33A and 33B The lower section 20A and the upper section 20B cooperate to define the circular opening 61 having an edge 60 which accommodates fountain roll 15. Lower section 20A is also provided with a generally semi-circular recess defined by the edge 27 for accommodating anilox roller 8. Lower section 20A is provided with a first air passage 72 formed by drilling and with a plurality of smaller air passages 73, 74, 75 which connect to passage 72 and communicate to atmosphere along the edge 60. Passage 72 also supplies a passage 76 which communicates to atmosphere in air flow groove 27A at the anilox roll 8. Upper section 20B is provided with a second air passage 78 which connects to smaller air passages 79 and 80 along the edges 60 and 27A, respectively. Air is supplied to the passages 72 and 78 through a pair of air supply lines 81 and 82 from air manifold 29 which is rigidly mounted on the outside of ink fountain pan 54. Manifold 29, in turn, is supplied from air pump 52. Lower section 20A of a divider 20 is positioned in ink fountain 18 between the sides 84 of bracket member 31 on top of a sealing member 25 and is secured in place by means of an air connection fitting 86 which is screwed down against a shoulder 87 on lower section 20A by means of a screw 32 which extends through a block 89 rigidly secured as by welding at the upper end of bracket member 31. As FIG. 5 shows, drainage spaces exist between the sides of the divider 20 and the sides 82 of the bracket member 31 and the sides 82 are provided with ink drain holes 90. The upper portion 20B of divider 20 is secured to the lower portion 20A by means of the bolts 33A and 33B which extend through holes 91 and 92, respectively, in upper section 20B and screw into threaded inserts 93 and 94, respectively, force-fitted in holes 95 and 96, respectively, in the lower section 20A. As hereinafter explained, the pneumatic sealing means or member 25 is disposed between the lower edge of divider 20 and ink pan 54. The adjusting screw 32 serves not only to effect a connection between air supply line 81 and air passage 72, but also serves to force air connection fitting 86 against shoulder 87 and thereby maintain the divider 20 pressed against sealing member 25.

The edge 60 around the opening 61 in divider 20 extends into the groove 28 in fountain roll 15 and affords such clearance as to enable the fountain roll 15 to rotate freely. Furthermore, the spacing is such as to permit the fountain roll 15 to be moved slightly (about one-sixteenth inch) to engage and disengage the anilox roll 8, while stil maintaining a positive air seal between the divider 20 and the groove 28 in fountain roll 15 and a mechanical seal between the divider 20 and the anilox roll 8.

During operation, air is supplied to a divider 20 from air supply pump 52, through air manifold 29, through air passages 72 and 78, and through the smaller passages 73, 74, 75, 76, 79, and 80. Air discharging from the passages 73, 74, 75 is discharged into groove 28 in fountain roll 15 and as FIG. 3 shows, is eventually expelled from the groove. Air discharged from the passage 79 and 80 into groove 27A along edge 27 eventually reaches atmosphere after leaking out from between the edge 27 and the anilox roll 8. Air pressure at these five openings is on the order of approximately 7 psi.

THE PNEUMATIC SEAL

As FIGS. 1, 2, 3, 4, 5, 6, and 9 show, each pneumatic seal 25 takes the form of an elongated hollow flexible rubber member which has an internal air passage 98 which is closed at one end by means of a plug 99 and which is connected at its other end by means of a hose 100 to air manifold 26. Air for operating each seal 25 is supplied by air pump 101 to air manifold 26 and is delivered at a pressure of about 20 psi. A regulator 102 is provided to enable settings up to 30 psi maximum pressure. Each sealing member 25 air loads its associated divider 20 thereby serving to maintain the desired settings made by the adjustement screws, regardless of wear on the divider 20 along edge 27 caused by frictional engagement of the divider with the periphery of the anilox roll 8.

OPERATION

As explained hereinbefore, each divider 20 cooperates with an associated pneumatic sealing member 25 to provide a fluid-tight seal between two adjacent compartments in the ink pan. Furthermore, each divider 20 cooperates with a groove 28 in fountain roll 15 to provide an air seal between two adjacent sections on the fountain roll 15. As FIG. 3 makes clear, air entering the groove 18 through a passage along the edge 60 forces its way out through the air spaces located between the sides of the groove 28 in the fountain roll 15 and the sides of the divider 20, as indicated by the arrows A in FIG. 3. Also, as FIGS. 2 and 3 make clear, the edge 27 rides against the surface of anilox roll 8 and the space or groove 27A in edge 27 directly confronts a portion of the surface of roll 8. Air from the passages 80 and 76 entering the groove 27A provides an air seal and the edge 27 bearing against roll 8 provides a mechanical seal thereby preventing ink flow past divider 20 along the surface of the anilox roll 8. Air flowing through the passage 75 and indicated by the arrows B in FIG. 3 eventually exits from groove 28 in fountain roll 15. It is most important to maintain air seals in the nip area of the rollers 8 and 15 to prevent lateral displacement of ink along either roll. However, as regards fountain roll 15, an air seal is maintained around the entire circumference thereof between adajcent roll sections. As FIGS. 2 and 6 make clear, each divider extends above the horizontal center line of the anilox roll 8 so as to accommodate or account for the upward carryover of ink due to the rotation of roll 8. As hereinbefore noted, the level of ink in ink pan 54 is below the periphery of the fountain roll 15 so as to reduce the burden on the seal between fountain roll 15 and divider 20. Thus, as hereinbefore explained, ink is applied to fountain roll 15, not by being picked up directly from a supply of ink in the pan 54, but by the ink nozzles 35A, 35B, 35C. Each ink nozzle

meters the amount of ink supplied to its associated portion of the fountain roll 15 and the flexible edge plate ensures even distribution along the fountain roll. If preferred, some other manner of applying ink to the fountain roll 15 could be employed such as spraying or the like.

As hereinbefore mentioned, the ink fountain anilox roll 8 and fountain roll 15, as well as the dividers 20, can be moved as a unit to and away from the printing roll 3. Furthermore, since it is sometimes necessary to effect a slight separation between the fountain roll 15 and the anilox roll 8 (on the order of one-sixteenth inch), it is desirable to be able to do so without interrupting the seal between a divider 20 and the ink fountain pan 54, or between the divider 20 and the fountain roll 15, or between the anilox roll 8 and the divider 20. As the two rolls 8 and 15 separate slightly, air pressure in the pneumatic sealing member 25 causes upward movement of divider 20 thereby ensuring that its edge 27 maintains contact with the periphery of anilox roll 8. Such movement is possible because, as FIGS. 2 and 3 make clear, there is radial clearance between the bottom of groove 28 in roll 15 and the circumferential edge 60 in divider 20. Even as divider 20 moves slightly with respect to roll 15, the air seal in groove 28 is maintained but physical contact between the divider 20 and the fountain roll 15 never occurs. In addition, as sealing member 25 expands, it moves the divider 20 upward but still maintains the sealed relationship with the bottom edge thereof.

Dividers such as 20 could be located at the ends of the fountain roll 15 and the anilox roll 8 to serve as end dams and to eliminate ink bead build up at the ends of the rolls which would otherwise be slung off the rolls onto the printing equipment.

We claim:

1. In a printing press:
a roll having two adjacent sections to which ink is applied;
an ink fountain including means for applying ink to said adjacent sections;
and means for preventing ink travel between said adjacent sections of said roll and for dividing said ink fountain into separate compartments, said means comprising:
a circumferential groove in said roll between said two adjacent sections;
a divider comprising at least two separable sections cooperating to define an opening therein for accommodating said roll, said divider completely surrounding said roll and comprising an edge along said opening which extends into and entirely around said groove, said divider further comprising a plurality of spaced apart gas holes near said edge to accommodate passage of compressed gas therethrough into said groove;
and a hollow resilient pneumatically operated sealing tube disposed between at least one of said sections of said divider and said ink fountain and operable to prevent ink flow between said compartments of said ink fountain and to bias said divider toward said roll.

2. In a printing press:
a pair of rolls in contact with each other to enable ink transfer therebetween;
a circumferential groove in one of said rolls dividing said one roll into two sections;
a divider having openings therein for accommodating said rolls, said divider having first and second edges along said openings, one of said edges extending into said groove in said one roll entirely therearound, the other of said edges adjacent the other of said rolls, said other edge having a groove therein, said divider comprising at least two sections cooperating to define the opening having said one of said edges;
said divider having air holes therein terminating at said first and second edges for accommodating the flow of compressed gas therethrough into said circumferential groove and against said other roll to prevent transfer of ink between said two sections of said one roll and across the surface of said other roll.

3. In a printing press:
a first roll;
a second roll in contact with said first roll whereby ink is transferred between said rolls;
a circumferential groove in said first roll dividing said first roll into two sections;
a divider comprising at least two separable sections cooperating to define a first opening therein for accommodating said first roll, said divider comprising a first edge along said first opening which extends into said groove entirely therearound;
said divider having first air holes along said first edge for accommodating the flow of compressed gas therethrough into said groove in said fountain roll to prevent the transfer of ink between said two sections of said first roll;
said divider having a second opening therein for accommodating said second roll, said divider comprising a second edge along said second opening adjacent said second roll, said second edge having a groove therein and having second air holes along said second edge groove for accomodating the flow of compressed gas therethrough against said second roll to prevent the transfer of ink along said second roll past said divider.

4. In a printing press:
a fountain roll having at least one circumferential groove therein for dividing said roll into sections;
an ink fountain associated with said fountain roll and having means for applying different colored inks to different sections of said fountain roll;
an anilox roll to which ink is transferred from said fountain roll;
a plurality of dividers for dividing the ink fountain into separate ink compartments, and for cooperation with said fountain roll and said anilox roll to prevent ink transfer between adjacent sections on each roll, each divider having a hole through which the fountain roll extends, each divider having a circumferential edge around said hole which extends into a groove on said fountain roll, each divider having another edge which rides against said anilox roll, said another edge being provided with a groove therein, a plurality of air ports disposed along said circumferential edge and said other edge and along said groove in said other edge;
means for supplying compressed air for expulsion through said holes;
a resilient hollow pneumatically operated sealing tube disposed between the bottom of each divider and said ink fountain to provide a mechanical seal therebetween and to bias said divider against said anilox roll;

and means for supplying compressed air to said sealing tube.

5. A printing press according to claim 4 wherein each divider comprises a lower section and a detachable upper section and means for releasably securing said lower and upper sections together.

6. A printing press according to claim 5 including means on said ink fountain and on said lower section of said divider for releasably securing said lower section to said ink fountain, and means on said upper and lower sections for releasably securing said upper and lower sections together.

7. A printing press according to claim 5 wherein said means for supplying compressed air for expulsion through said holes comprises passages in said upper section and said lower section of said divider;

a source of compressed air;

at least one air supply line connected between said source and said passages in said divider, said supply line being connected to an air supply fitting;

a screw connected to said ink fountain and bearing against said air supply fitting, said screw being adjustable to connect said fitting to a passage in said lower section of said divider and to force said lower section of said divider against said sealing tube.

* * * * *

18

United States Patent [19]

Edwards

[11] **4,222,325**

[45] **Sep. 16, 1980**

[54] **MOUNTING MEANS FOR MOVABLE CARRIAGE ON AN OFFSET PRESS**

[75] Inventor: **Robert Edwards,** Dudley, Mass.

[73] Assignee: **White Consolidated Industries, Inc.,** Cleveland, Ohio

[21] Appl. No.: **936,826**

[22] Filed: **Aug. 25, 1978**

[51] **Int. Cl.**[3] **B41F 7/08;** B41F 7/40; B41F 31/34

[52] **U.S. Cl.** **101/137;** 101/148; 101/177; 101/185; 101/247; 101/351; 101/248

[58] **Field of Search** 101/177, 183, 184, 185, 101/136, 137, 140, 141, 142, 143, 144, 145, 247, 209, 351, 352, 178, 182, 138, 139, 179, 180, 181, 148

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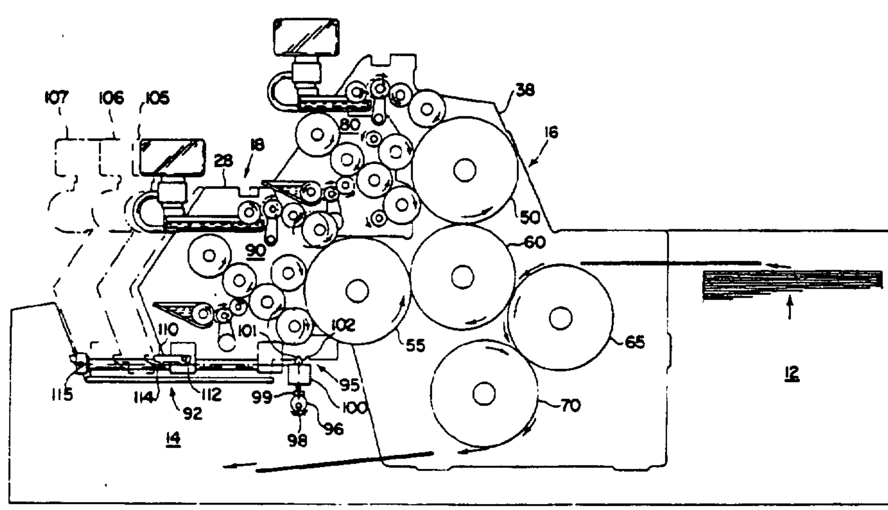
Primary Examiner—J. Reed Fisher
Attorney, Agent, or Firm—Pearne Gordon Sessions

[57] **ABSTRACT**

A two-color offset printing press having two plate cylinders simultaneously engageable with a single blanket cylinder is disclosed. The plate cylinders and a blanket cylinder are rotatably mounted on a printer head fixed to the mainframe of the press. A first set of dampening and inking rollers is mounted on the printer head and engageable with one of the plate cylinders. A second set of dampening and inking rollers, engageable with the other plate cylinder, is mounted on a ball bushing supported carriage linearly movable to and from the printer head along a pair of parallel rails fixed to the mainframe. Image registry between the two plate cylinders is established by an operator-accessible adjustment mechanism for shifting one of the plate cylinders back and forth along its axis of rotation. An electrical safety interlock system precludes operator access to the carriage-associated plate cylinder during predetermined operating modes of the press.

2 Claims, 13 Drawing Figures



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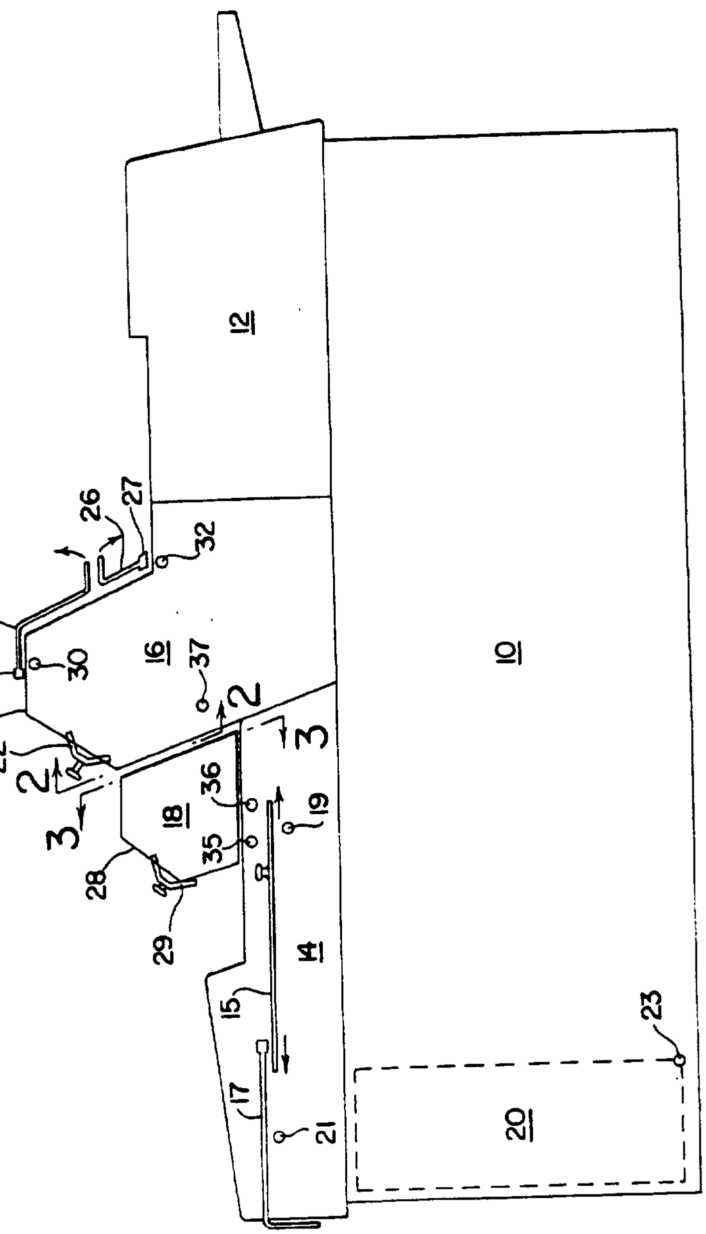
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FIG. 1

FIG. 3

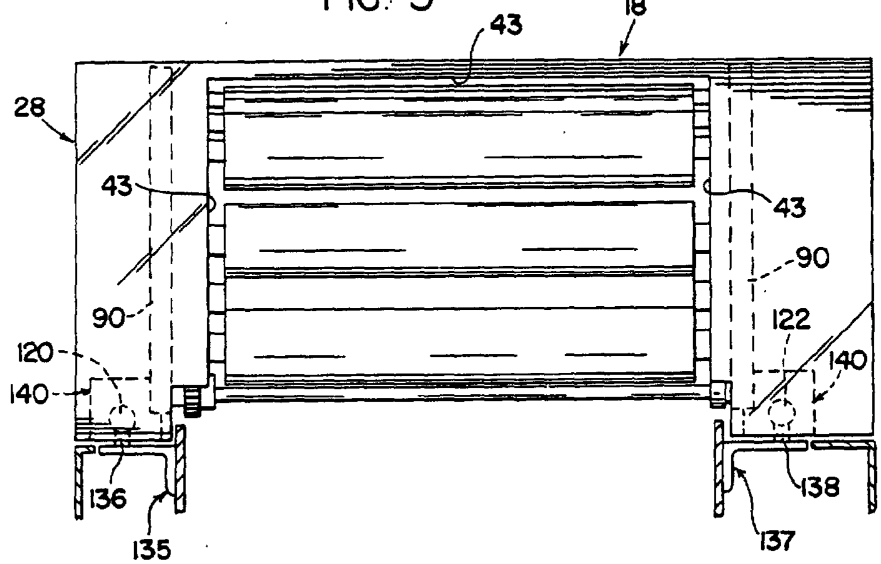


FIG. 2

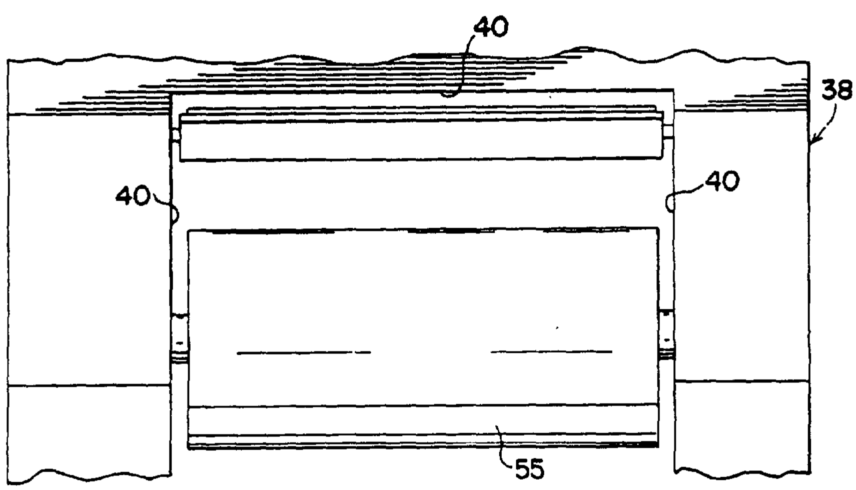
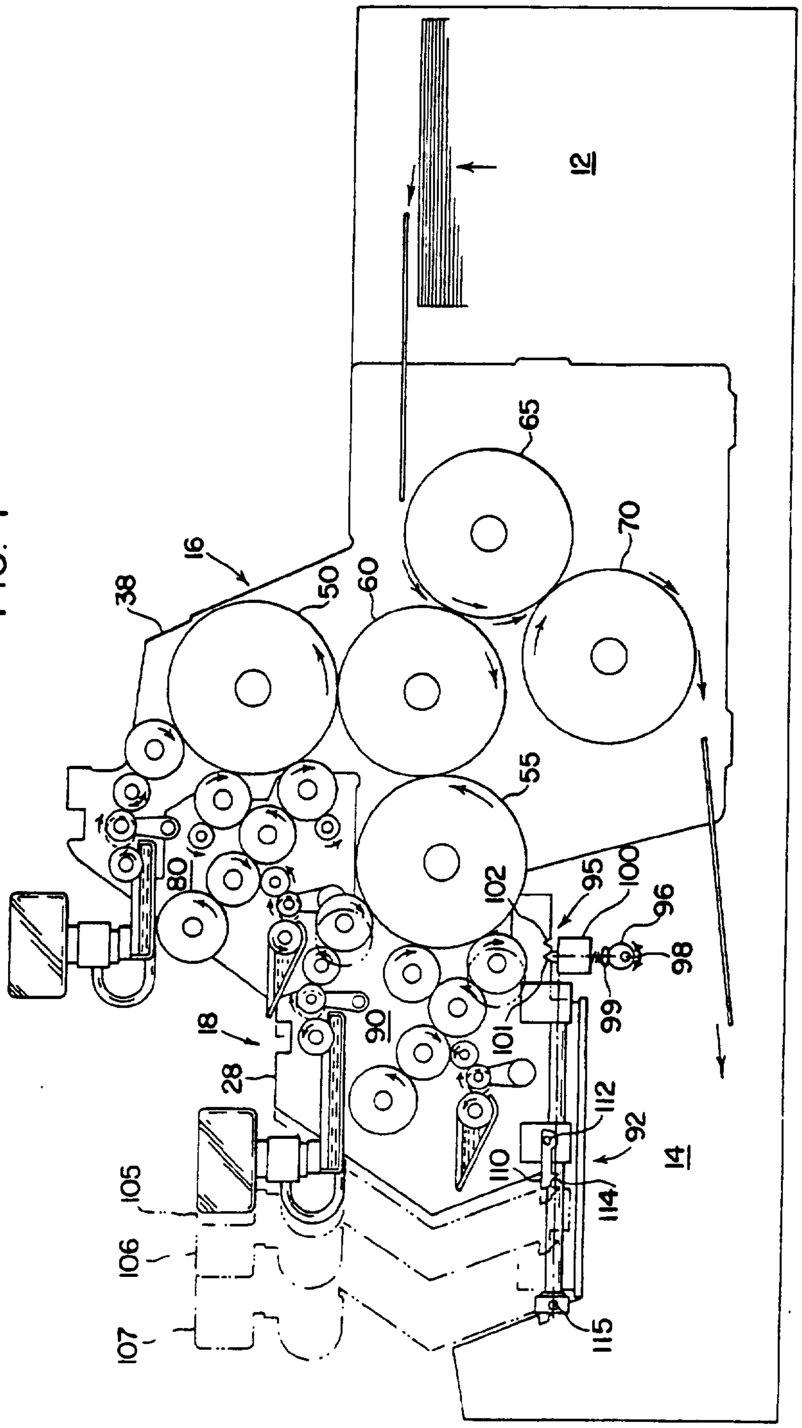


FIG. 4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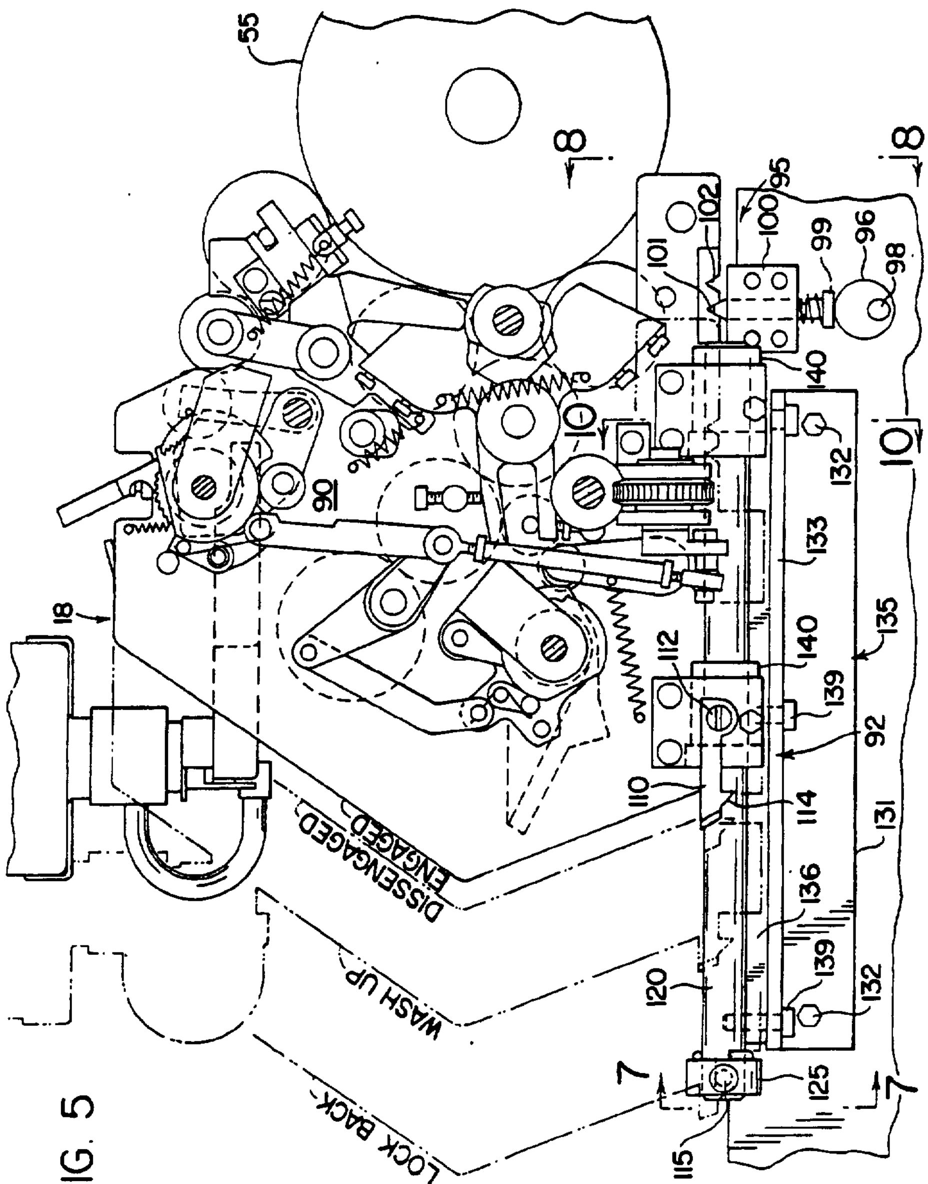
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WASH UP
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LOCK BACK

FIG. 5

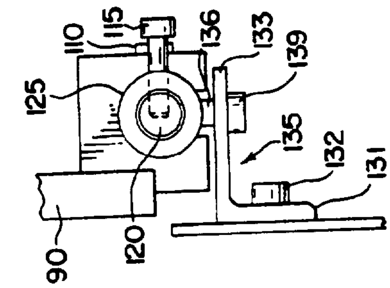
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FIG. 7

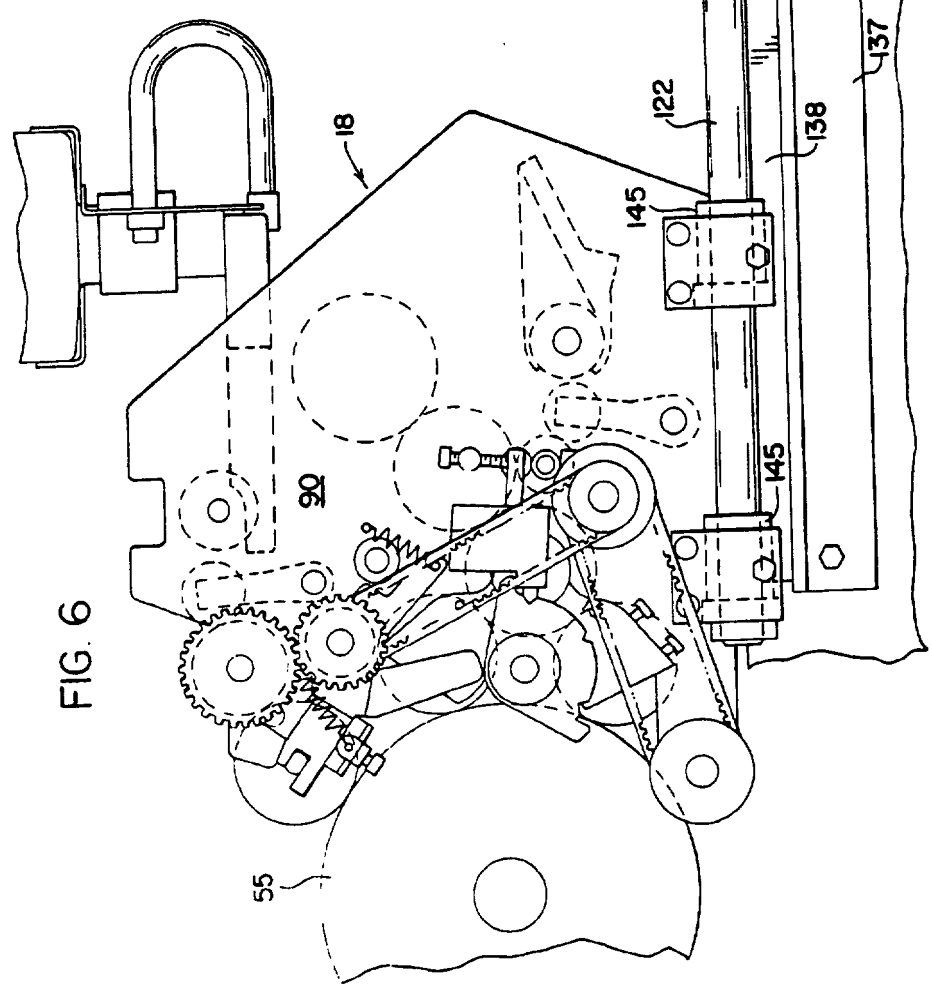
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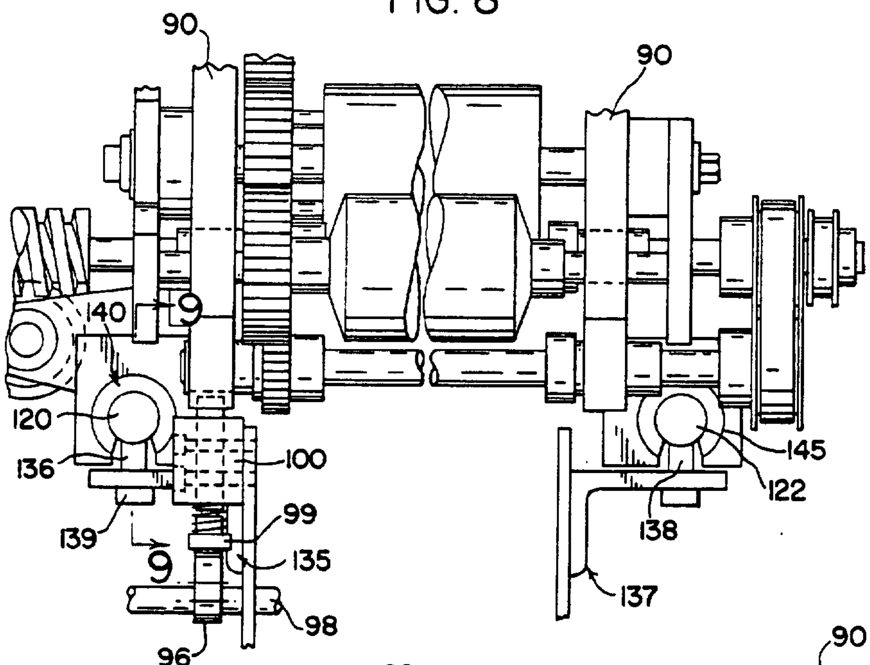
FIG. 6

FIG. 8



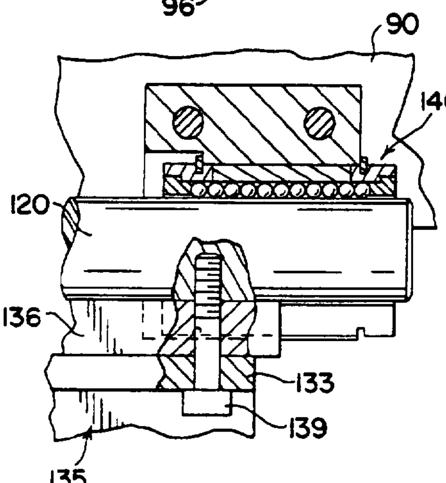


FIG. 9

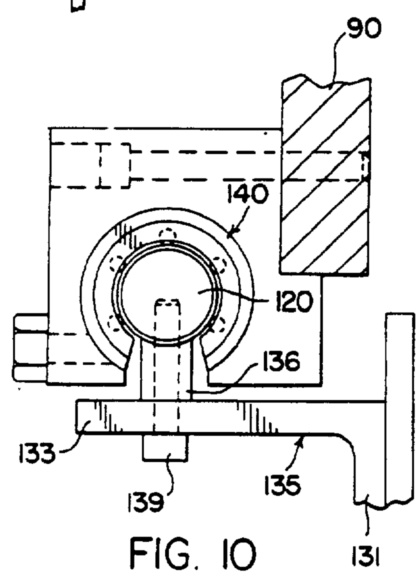


FIG. 10

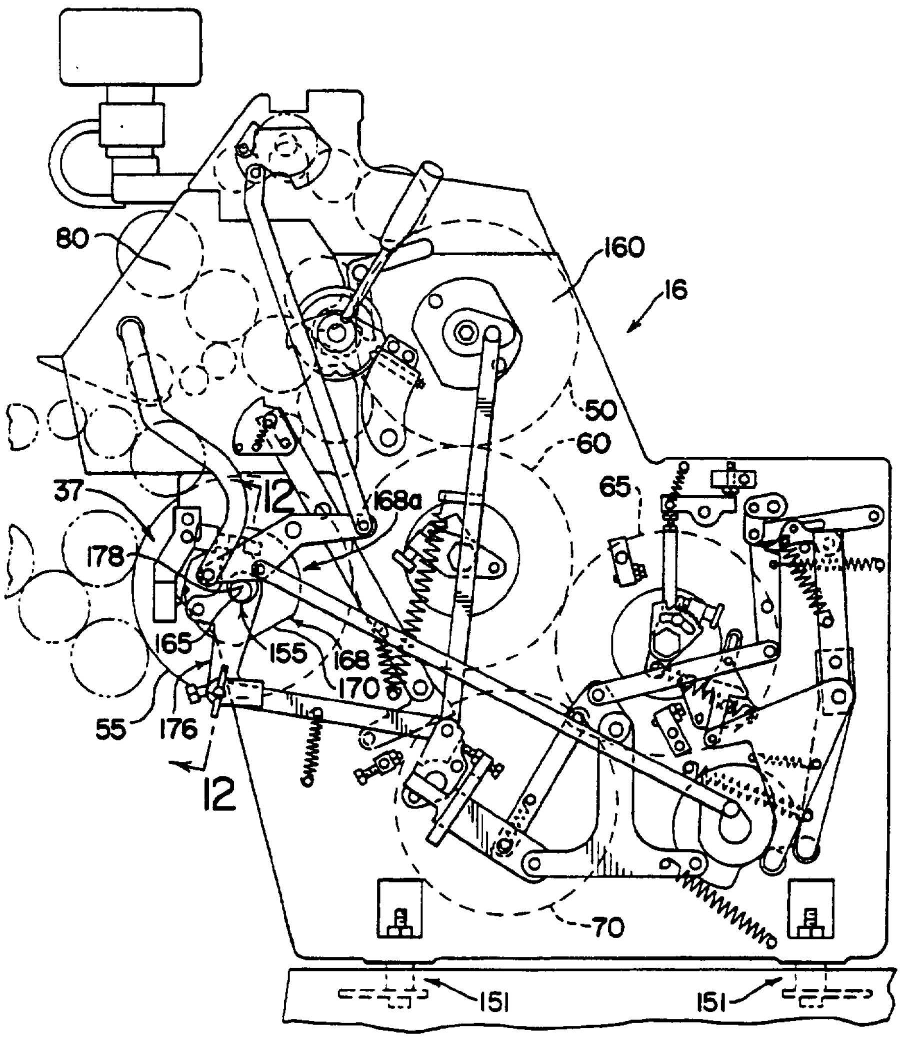


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FIG. 11

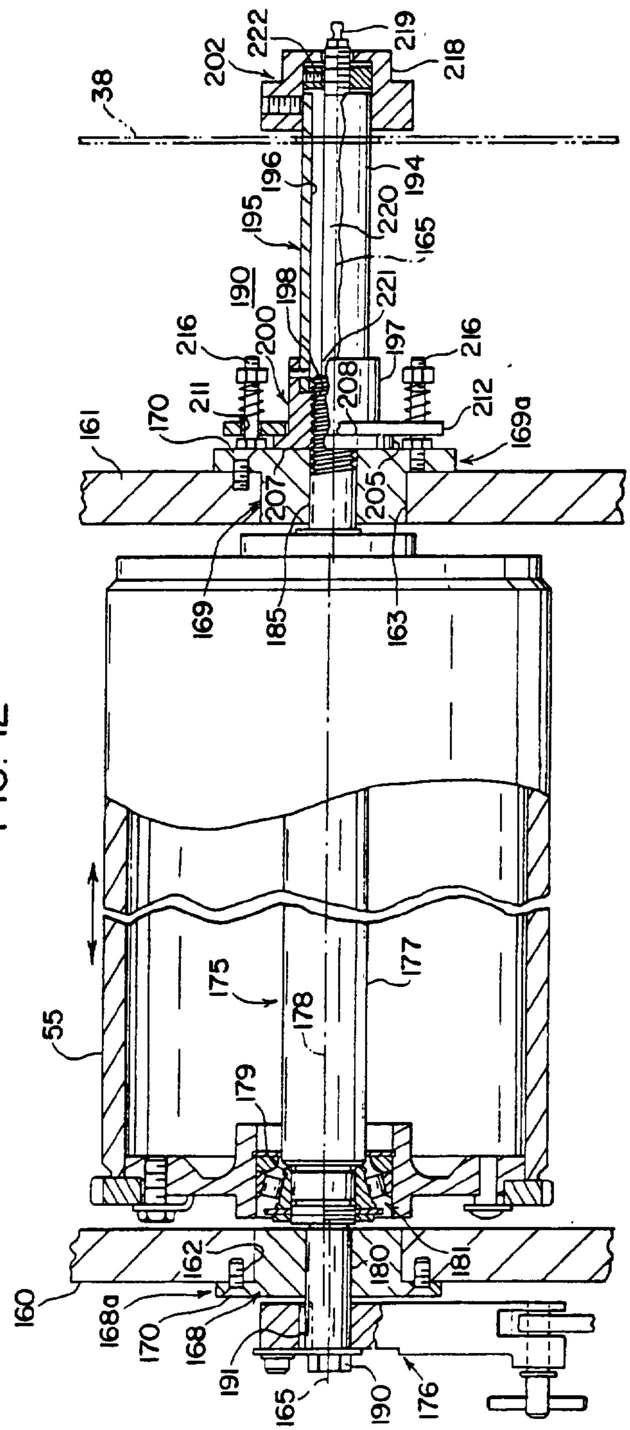

FIG. 12

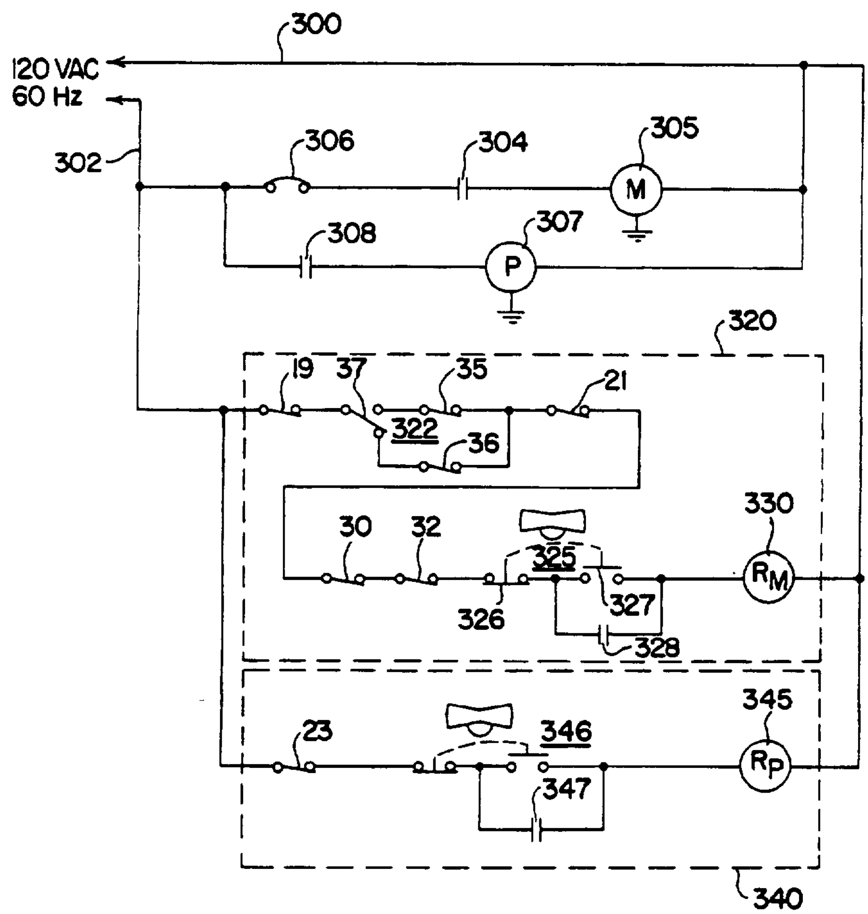
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FIG. 13

MOUNTING MEANS FOR MOVABLE CARRIAGE ON AN OFFSET PRESS

BACKGROUND OF THE INVENTION

This invention relates to offset printing, and in particular to an offset printing press having a dampening and inking roller-containing carriage linearly movable to and from an associated plate cylinder.

The set of dampening and inking rollers on the carriage, when moved to an engagement position with a respective plate cylinder, must be properly positioned relative to the plate cylinder to provide controlled amounts of inking and dampening fluid to the plate cylinder. To provide such proper positioning, it is necessary that lateral and skewing movements of the linearly movable carriage be eliminated.

The prior art, as represented by U.S. Pat. No. 3,521,559 to Sejeck et al., is intended to provide proper positioning of a linearly movable ink roller-containing carriage relative to its respective plate cylinder by the use of interlocking abutting slide members of wear-resistant, low friction, synthetic resin. The slide members are intended to preclude lateral shifting or skewing of the carriage to provide for proper positioning of the carriage-contained ink rollers relative to their respective plate cylinder. Such a slide arrangement is further intended to give all the benefits of a more expensive machined dovetail slide arrangement.

While the Sejeck et al. slide arrangement may represent a cost improvement over a conventional dovetail type slide, such a slide arrangement would still be susceptible to surface-to-surface sliding friction wear as is a dovetail-type slide. Further, the weight of the moving carriage may have to be limited to prevent degeneration of the relatively soft synthetic resin material used to form the Sejeck et al. carriage-supporting slide members.

SUMMARY OF THE INVENTION

In accordance with the present invention, a printer head, including at least one rotatably mounted blanket cylinder and at least one rotatably mounted plate cylinder engageable with the blanket cylinder, is mounted on and fixed to a mainframe which supports a dampening and inking roller-containing carriage linearly movable to and from the printer head on a set of rolling-friction bearing surfaces. The carriage is positively lockable at predetermined locations lying along its linear path of movement to and from the printer head. In a preferred form the invention includes a plurality of linear motion ball bushings fixed to the carriage. The bushings in turn ride on a pair of mainframe-supported circular cross section rails that are parallel to and lie along either side of an axis normal to the axis of rotation of the plate cylinder which engages the set of dampening and inking rollers on the movable carriage when it is in an engagement position closest to the printer head.

The invention provides accurate linear movement of the carriage relative to its associated plate cylinder without lateral or skewing movements of the carriage, such positive linear motion precluding misalignment of the plate cylinder and its carriage-mounted set of dampening and inking rollers. Linear carriage movement is provided by the present invention at a relatively low cost and with high reliability. The rolling friction bearing surfaces provided by the preferred linear motion ball bushings in accordance with the invention advantageously provide extremely low friction movement of the carriage as opposed to the higher surface-to-surface friction slide mechanism of the prior art.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic elevation view from the operator's side of a two-color offset printing press, with covers in place, in accordance with the present invention;

FIG. 2 is an elevation view of the printer head of the press taken along line 2—2 of FIG. 1;

FIG. 3 is an elevation view of the movable carriage of the press taken along line 3—3 of FIG. 1;

FIG. 4 is a schematic elevation view from the operator's side of the press, with covers removed;

FIG. 5 is an operator's side, elevation view of the movable linking and dampening roller-containing carriage illustrating various carriage positions;

FIG. 6 is a nonoperator's side, elevation view of the movable inking and dampening roller-containing carriage supported by linear motion ball bushings;

FIG. 7 is an end view of a portion of the carriage mounting means taken along line 7—7 of FIG. 5;

FIG. 8 is an end view of the press carriage, with portions cut away, taken along line 10—10 of FIG. 5;

FIG. 9 is a longitudinal, cross section view of one of the ball bushing mountings of the carriage taken along line 9—9 of FIG. 8;

FIG. 10 is a transverse, cross section view of one of the ball bushing mountings of the carriage taken along line 10—10 of FIG. 5;

FIG. 11 is an operator's side, elevation view of the printer head of the press;

FIG. 12 is a longitudinal cross section view of the axially adjustable plate cylinder taken along line 12—12 of FIG. 11; and

FIG. 13 is a schematic diagram of the printing press safety interlock system.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference to FIG. 1, there is schematically illustrated in elevation a two-color offset printing press in accordance with the present invention wherein a mainframe 10 having a paper feed input 12 and a paper delivery output 14, supports a fixed printer head 16 and a carriage 18 linearly movable to and from the printer head 16.

The printer head 16 includes a pair of plate cylinders engageable with a blanket cylinder, in turn engageable with an impression cylinder, in turn engageable with a delivery cylinder. The printer head 16 further includes a first set of dampening and inking rollers engageable with one of the plate cylinders.

The movable carriage includes a second set of dampening and inking rollers engageable with the other plate cylinder mounted on the printer head.

The detailed structure of the printer head 16 and carriage 18 will be illustrated and discussed subsequently.

By way of example, and with further reference to FIG. 1, in a typical offset printing operation, blank printing paper in a stream of sequentially fed separate sheets, is provided by the paper feed input 12 to the printer head 16 wherein the paper passes between the image-containing blanket cylinder and an impression cylinder, the image on the blanket cylinder being transferred in a well-known manner to the paper. The

printed paper is then transferred via the paper delivery output 14 from the printer head 16 into a conventional vertically extending sheet stacking bin 20. The feeding of the printing paper to the printer head 16 by the paper feed input 12 and the delivery of the printed paper from the printer head 16 to the bin 20 by the paper delivery output 14 are provided by conventional chain transport systems well-known in the art.

To ensure safe operation of the press of the present invention, a plurality of fixed and movable covers are provided to limit operator access to moving parts of the press. The printer head 16 includes a cover 22 and two cooperating plate cylinder covers 24, 26, as shown in FIG. 1. The covers 22, 24, 26 serve to close printer head access openings used for maintenance or set-up of the press in a non-running condition. The plate cylinder covers 24, 26 are each pivotal about respective hinge joints 25, 27 fixed relative to the printer head 16. Associated with the covers 24, 26 are respective interlock switch means 30, 32 which are responsive to movement of their respective associated covers 24, 26 wherein opening and closing of the covers 24, 26 actuate the interlock switches 30, 32. In a manner to be subsequently explained in detail, opening of the covers 24, 26 by moving either of them pivotally away from the printer head 16 actuates the respective interlock switches 30, 32, which in turn deenergize the press drive motor to preclude operator access to moving press parts such as rotating cylinders and rollers mounted on and within the printer head 16. The cover 22 and movable covers 24, 26 cooperate with a printer head housing 38 to generally enclose the cylinder and rollers within the interior volume generally defined by the printer head housing 38.

The paper delivery output 14 includes a linearly slidable cover 15 and a cooperating pivotal cover 17, which limits operator access to the paper delivery chain drive when the paper delivery covers 15, 17 are in their closed position as illustrated in FIG. 1. Associated with the covers 15, 17 are respective interlock switch means 19, 21 which function to deenergize the press motor when the respective covers are in an open position as opposed to their closed illustrated positions. A bin overload interlock switch means 23 functions to deenergize the paper feed process when the bin 20 is full.

The carriage 18 includes a housing 28 and a cover 29 which generally encloses the interior mechanism of the dampening and inking roller-containing carriage 18, such mechanism to be explained subsequently in detail. Two carriage-related interlock switches 35, 36 are responsive to linear movement of the carriage 18 away from and toward the printer head 16. The carriage-related interlock switches 35 and 36 cooperate with a plate cylinder interlock switch means 37, the switching means 37 being responsive to the movement of a carriage-associated, printer head-mounted, plate cylinder into and out of an engaged position with the printer head-mounted blanket cylinder. The cooperating switch means 35, 36, 37 function together to limit operator access to moving parts within the printer head housing 38 and the carriage housing 28 when the carriage 18 is pulled back away from the printer head 16.

The heretofore discussed switch means are preferably in the form of mechanical microswitches, although other types of switches, such as optical coupler-type relays, are clearly applicable. The precise manner in which the above-noted plurality of interlocking switching means cooperate to deenergize the press motor to preclude unsafe operation of the press will be subsequently explained in detail.

With reference to FIG. 2 taken along line 2—2 of FIG. 1, it can be seen that the printer head housing 38 provides an edge wall 40 which circumscribes and defines a rectangular aperture for operator access to the interior of the housing 38 containing the printer head-mounted cylinders and rollers.

With reference to FIG. 3 taken along line 3—3 of FIG. 1, it can be seen that the carriage housing 28 has an edge wall 43 which circumscribes and defines a rectangular aperture for access to the interior of the dampening and inking roller-containing carriage housing 28.

When the carriage 18 is pulled back or withdrawn away from the printer head 16 to a prescribed degree, operator access to both the interior of the carriage housing 28 and the interior of the printer head housing 38 is provided via the noted rectangular apertures. When the carriage 18 is moved to a position closest to the printer head 16, the housing edge walls 40, 43 abut in opposing relation (FIG. 1) to limit operator access to the interior of the housings 28 and 38 wherein the housings cooperate with each other and with the earlier-noted covers 22, 24, 26, 29 to generally enclose the cylinder and roller mechanisms of the printer head 16 and carriage 18, respectively.

Turning to FIG. 4, there is illustrated, in accordance with the invention and in a more detailed manner, the printer head 16 and the carriage 18, which are generally enclosed by their respective housings 28, 38, schematically represented in outline fashion. The printer head 16 includes a first plate cylinder 50, a second plate cylinder 55, a blanket cylinder 60, an impression cylinder 65, and a delivery cylinder 70.

The plate cylinders 50, 55, the blanket cylinder 60, the impression cylinder 65, and the delivery cylinder 70 are interengageable and rotatably mounted on the printer head 16. Each of the cylinders 50, 55, 60, 65, 70 lies along parallel axes of rotation with their outer surfaces of revolution in generally opposed, abutting relationship, as illustrated. Associated with and mounted on and fixed to the printer head 16 is a first set of dampening and inking rollers 80 rotatable on axes of rotation parallel to the axes of rotation of the printer head cylinders. The set of dampening and inking rollers 80 is conventional and functions to provide the first plate cylinder 50 with dampening and inking fluid in a well-known manner.

Associated with and mounted on and fixed to the movable carriage 18 is a second set of conventional dampening and inking rollers 90 located along axes parallel to those of the printer head cylinders. The second set of dampening and inking rollers functions to provide the second plate cylinder 55 with dampening and inking fluids as illustrated.

In a two-color printing operation, the carriage 18 is moved to an engagement position closest to the printer head 16, as illustrated in FIG. 4, wherein the second set of dampening and inking rollers 90 contacts the second plate cylinder 55, as illustrated, via the apertures defined by the carriage and printer head housing edgewalls 40,43 (See FIGS. 2 and 3). The first set of dampening and inking rollers 80 contacts the first plate cylinder 50.

In operation, the plate cylinders 50, 55 each contain, in wraparound fashion, a single-color image-carrying plate which is inked and dampened in a conventional manner by the sets of dampening and inking rollers 80,

90, the directions of cylinder and roller rotation being indicated in FIG. 4. Images from the plate cylinders 50, 55 are simultaneously transferred and superimposed in proper registry upon the blanket cylinder 60. The superimposed images on the blanket cylinder 60 are then simultaneously transferred to the blank printing paper fed between the blanket cylinder 60 and the impression cylinder 65. The printed paper is then stripped from the impression cylinder 65 by the delivery cylinder 70. The movement of the paper between the paper feed input 12 and the paper delivery output 14 defines a sinuous paper handling path extending therebetween, as illustrated in FIG. 4.

The process of printing on paper with two single-color plate cylinders cooperating with a blanket cylinder, which in turn cooperate with respective impression and delivery cylinders, is known in the art, as is a paper handling means generally illustrated in FIG. 4.

In accordance with the invention, the second plate cylinder 55 is rotatably mounted and fixed to the printer head 16, while its associated set of dampening and inking rollers 90 is mounted on and fixed to the movable carriage 18. The carriage 18 is preferably linearly movable to and from the second plate cylinder 55 in a manner to be subsequently explained and lockable at a predetermined number of positions along its travel length by means, of, for example, a detent mechanism 95 or a simple latch mechanism 92.

As illustrated in FIG. 4, the carriage is in an engagement position for a typical two-color offset printing operation as earlier discussed. In accordance with the invention, it can be seen that the detent mechanism 95 as shown in FIG. 4 locks the carriage 18 at the engagement position. The positive locking of the carriage is position by the detent mechanism 95 is accomplished by rotating an eccentrically mounted, vertically extending cam member 96 about a pivot pin 98. Rideable upon the outer upper edge of the cam member 96 is a spring-biased pin 99 which reciprocates to and from the carriage 18 upon a predetermined degree of rotation of the cam member 96. With the cam member 96 in a locking position as illustrated in FIG. 4, the pin 99, slidable upward through a collar 100 fixed relative to the press mainframe, projects into a receiving detent cavity 101 to positively lock the carriage at the illustrated engagement position.

As illustrated in phantom in FIG. 4, the carriage is leftwardly linearly movable back from the illustrated engagement position to a disengagement position 105 which is utilized when the press is operating in a single-color mode. Movement from the illustrated engagement position to the phantom-illustrated disengagement position 105 is accomplished by rotation of the cam member about its pivot pin 98 for approximately 180 degrees from its position illustrated in FIG. 4, causing the pin 99 to move downwardly and drop out of the detent cavity 101, wherein the operator pulls the carriage back away from the printer head 16 to the disengagement position 105, and wherein the cam member 96 is again rotated 180 degrees about the pivot pin 98 to push the pin 99 upward into a disengagement detent cavity 102 for positive locking of the carriage 18.

The carriage is also linearly movable to a further degree away from the printer head 16 to a wash-up position 106 at which the carriage is positively lockable by a mechanism similar to the detent mechanism 95 but not illustrated. It is further noted that the nonoperator side (FIG. 6) of the carriage 18 may include a detent locking mechanism which is opposite but substantially identical to the illustrated detent mechanism 97. The opposed detent mechanism and the illustrated operator side detent mechanism 97 can operate together via a common shaft extending across the carriage from the location of (and in substitution for) the pivot pin 98 to the pivot pin location of the opposed detent mechanism. Such a mechanism permits positive locking of both sides of the carriage 18.

The carriage is further movable to a lock-back position 107 farthest from the printer head 16, wherein positive locking of the carriage in the lock-back position 107 is provided by the pivotally movable latch member 110 mounted to the carriage via a pivot pin 112. As the carriage moves away from the printer head to the lock-back position, the latch member is raised up by a horizontally inclined camming surface 114 for latching engagement with a keeper 115 in the form of a horizontally projecting pin or rod fixed relative to the mainframe in a manner to be explained in more detail.

The rotatable mounting and fixing of the second plate cylinder 55 to the printer head ensures proper alignment between such second plate cylinder 55 and the blanket cylinder 60. The provision of a linearly movable carriage containing the set of dampening and inking rollers 90 which can be withdrawn from the second plate cylinder 55 advantageously permits ready access to the second plate cylinder and to the carriage-mounted dampening and inking rollers for set up procedures and usual maintenance.

Turning to FIGS. 5 and 6, a more detailed illustration of the carriage 18 is presented from the operator's side as shown by FIG. 5 and from the opposed or nonoperator's side shown in FIG. 6. The carriage rides upon a pair of straight parallel rails 120 (FIG. 5) and 122 (FIG. 6) which are supported by and mounted relative to the mainframe of the press. The carriage is movable along the rails 120, 122 between a pair of lock-back, end stop, ringlike collars 125, 126 and the printer head 16 with which the carriage abuts in its engagement position. The collars 125, 126 fit around the rails 120,122 not immediately adjacent to the printer head 16 and are locked to their respective rails 120, 122 by, for example, appropriate setscrews.

The rails are each supported along substantially their entire lengths by an associated pair of L-shaped cross section lengths of angle iron 135, 137 and by generally equal parallel extending lengths of generally-rectangular cross section bar stock 136, 138 positioned between and engaging the angle iron lengths 135, 137 and the respective rails 120, 122. The rails 120, 122, the lengths of bar stock 136, 138, and the lengths of angle iron 135, 137 are rigidly fixed to each other by appropriate fastening means, such as bolts, welds or the like. The lengths of angle iron 135, 137 are in turn rigidly fastened to the press fame. Thus, straight rails 120, 122 rigidly fixed relative to the press frame are parallel to each and extend along and are parallel to an axis normal to the axis of rotation of the second plate cylinder 55 (FIG. 4). The set of dampening and inking rollers 90 have axes of rotation which are normal to the linear motion direction of the carriage and parallel to the axis of rotation of their associated plate cylinder 55.

As illustrated in FIGS. 5 and 6, the carriage 18 having a generally rectangular base area rides the rails 120, 122 on supportive rolling friction bearing means in the form of two pairs of linear motion partial ball bushings 140, 145, each pair riding a respective rail 120, 122. Such

mounting of the carriage structure advantageously provides positive linear motion of the carriage 18 toward the printer head 16 without lateral or skewing movements of the carriage 18 relative to the printer head 16, which could cause misalignment between the set of inking and dampening rollers 90 and the respective second plate cylinder 55.

Turning to FIG. 7, it can be seen that the length of angle iron 135 has a vertically extending leg 131 which is fastened to the press frame by appropriate bolts 132 (only one illustrated). A horizontally extending leg portion 133 of the length of angle iron 135 supports the generally equal length of bar stock 136 which has a generally rectangular cross section (shown more clearly in FIG. 8). The length of bar stock 138, as illustrated in FIG. 7, is held in place against the horizontally extending flange 133 by appropriate bolts 139 (only one shown). The lock-back collar 125 fastened to an end of the rail 120 farthest from the printer head 16 has extending from it in a generally horizontal direction outwardly from the carriage the keeper 115 with which the latch member 110 engages when the carriage is in its lock-back position (FIGS. 4 and 5) as illustrated and earlier discussed with regard to FIG. 4.

Turning to FIG. 8, the mounting of the carriage 18 upon the rails 120, 122 is further illustrated. It can be seen that the ball bushings 140, 145 extend only partially about the circumferential extent of the rods 120, 122. Such linear motion partial ball bushings are further illustrated in FIGS. 9 and 10, where it can be seen that a series of circulating ball bearings move in a line along the longitudinal extent of the rail 20. In FIG. 10 it can be seen that the weight of the carriage is substantially supported only by the lines of recirculating ball bearings so as to provide only rolling friction forces between the carriage and the rail upon which it is movable. Linear motion partial ball bushings of the type illustrated are known in the art and available from Thomson Industries, Inc. of Manhasset, N.Y. With regard to the rail 122 and its related ball bushings 145, it should be noted that their structural relationship to each other is generally identical to the structural relationship between the other rail 120 and ball bushings 140 as discussed with regard to FIGS. 7, 9 and 10.

Turning to FIG. 11, there is illustrated in more detail from the operator's side the printer head 16 which is mounted on and fixed to the mainframe 10 of the press using a plurality of supportive bolts 151. The printer head 16 has rotatably mounted on it the plurality of parallel oriented and generally abutting cylinders in the form of the first plate cylinder 50, the second plate cylinder 55, the blanket cylinder 60, the impression cylinder 65, and the delivery cylinder 70. The rotatable mounting of the second plate cylinder 55 utilizes an eccentric mounting 155 well-known in the art which permits limited translational shifting of the second plate cylinder 155 to and away from the blanket cylinder 60 where, for example, only a single-color operation is required when only the plate cylinder 50 is engaged with the blanket cylinder 60. Such translational shifting of the plate cylinder 55 causes opening and closing of the switch means 37 (FIG. 1) illustrated in FIG. 11 as a microswitch response to press linkage movements associated with the noted translational movement of the plate cyiilinder 55. The utilization of the switch means 37 will be discussed in more detail with regard to the press safety interlock system. The control linkage illustrated in FIG. 11 is of the typical type.

With reference to FIG. 12, there is illustrated in longitudinal across section an operator-accessible mechanism for axially adjusting the second plate cylinder 55 to establish proper superposition or registry of the two-plate cylinder images transferred to the blanket cylinder as explained earlier.

The second plate cylinder 55 is rotatably mounted on and between two opposed and parallel printer head frame members 160, 161. Opposed, cylindrical, aperture-defining walls 162, 163 concentric with a common axis 165, each engagingly receive respective concentric, cylindrical, ringlike bushings 168, 169, which each include respective radially extending flange portions 168a, 169a. The bushings 168, 169 are fixed within the apertures defined by the walls 162,163 to their respective frame members 160, 161 by appropriate screw fasteners 170.

Extending between the bushings 168,169 is a plate cylinder shaft 175 which has a cylindrical midportion 177 having an axis of revolution 178 which is eccentrically set off by a predetermined amount from the axis 165 along which the concentric bushings 168,169 are oriented. The shaft 175 further includes a non-threaded cylindrical end portion 180 received by the bushing 168. The shaft 175 further includes a threaded cylindrical end portion 185 received by the bushing 169. The cylindrical end portions 180,185 lie along their common axes of revolution 165, while the shaft midportion 177 lies along its axis of revolution 178. The two axes 165,178 are parallel to each other wherein the end portions 168,169 of the shaft are eccentric by an equal radial and angular degree relative to the shaft midportion 177. Both of the axes 165,178 are normal to the parallel plane defined by the frame members 160,161 to provide parallel positioning of the second plate cylinder 55 relative to the blanket cylinder 60 (FIG. 11), which is also mounted along an axis normal to the planes defined by the frame members 160,161.

The plate cylinder 55 is rotatably mounted upon reduced end portions 179 (only one shown) of the midportion 177 of the shaft 175. Suitable bearing means, such as tapered roller bearings 181 (only one shown), are utilized at each end of the cylindrical plate cylinder 55 to rotatably mount it on the shaft 175 which is generally not rotatable around the axis 178. The shaft 175 is axially movable to a limited degree between the frame members 160,161 by being axially slidably and rotationally received within the bushings 168,169.

Limited translational movement of the plate cylinder 55 to and from and into and out of engagement with the associated blanket cylinder 60 (see FIG. 11) is provided by rotation of the eccentric end portions 180,185 on the axis 165, such end portion rotation causing the noted translational movement of the shaft midportion 177 and the associated rotationally mounted plate cylinder 55. A suitable linkage 176 (as further illustrated in FIG. 11) is utilized to rotate to a limited degree the shaft end portions 180,185 to provide the noted translational movement of the rotatably mounted cylinder 55. The linkage 176 is fixed to the distal end of the nonthreaded end portion 180 by means of a bolt 190 and shaft key means 191 to limit the degree of rotation of the shaft 175 to substantially less than a full revolution. The use of such eccentric cylinder mountings (Also see element 155, FIG. 11) is well-known in the art, and such mountings can be adapted to any of the cylinders or rollers of the press where such a translational movement function is desirable.

To adjust and maintain the position of the axially movable shaft 175 slidable within the ringlike bushings 168,169, an adjustment mechanism 190 is provided in accordance with the invention. The mechanism 190 includes a spindle 195 having a shaft-engaging end 200 and an operator-accessible distal end 202 which extends through the printer head cover 38 for operator access. The spindle 195 is rotatable on the axis 165, and in a preferred form includes a tube having outer and inner cylindrical walls 194,196. The shaft-engaging end 200 of the spindle 195, which further includes a ringlike collar 197, is threaded on its inner cylindrical wall 198 to engagingly receive the threaded end portion 185 of the shaft 175. While the spindle 195 is rotatable about the axis 165, it is generally not translationally movable along the axis 165. On the other hand, the spindle 175, while axially movable to a limited degree, is in general not rotatable about the axis 178, but for the limited degree of eccentric shaft rotation to cause the earlier-discussed translational movement of the cylinder 55. It can be seen that rotation of the spindle 195, which is generally fixed axially, will cause axial movement of the generally nonrotatable shaft 175. The degree of movement caused by a single revolution or rotation of the spindle 195 depends upon the thread pitch of the threaded end portion 185.

To maintain a set axial position of the shaft 175 and its rotatably mounted plate cylinder 55, a friction biasing means is provided to lock the spindle at a particular rotational location and to substantially limit axial movement of the rotatable spindle 195. In a preferred form, the friction biasing or locking means includes a spindle flange portion 205 extending radially from the shaft-engaging end portion 200 of the spindle 195. The flange portion 205 provides first and second annular friction engaging faces 207, 209 which are concentric with the spindle 195. The first annular face 207 engages with a corresponding annular area of the frame provided, as illustrated, by the bushing flange portion 169a. The second annular face 208 frictionally engages with a corresponding opposed annular area provided by a ringlike member 212 which is biased against the second annular face 208 of the flange 205 by appropriate helical spring means 214 extending between the distal ends of studs 216 extending normally from the frame member 161, the studs 216 having lengths substantially in excess of the thick of the flange 205, as illustrated. The studs 216 are equidistantly spaced about the spindle 195 and project through correspondingly equidistant space apertures 211 through the ring member 212. Spring biasing of the ring member 212 against the flange 205 effectively sandwiches the flange between the biased ring member 212 and the bushings 169 to limit axial movement of the rotatable spindle 195. The clutching effect provided between the annular faces 207, 208 and the respective mating annular portions of the bushing 169 and ring member 212 act as an effective means to maintain the axial position of the plate cylinder 55 once it has been set by operator turning of the spindle end 202, which may include a knob 218 fixed thereto. A conventional grease fitting 219 is fixed to the distal end of a hollow rod 220 having its other end 221 threaded into an axial bore (not shown) through the spindle 185, the axial bore communicating with the pair of roller bearings 181. Lubricant is applied under pressure via the grease fitting 219, the hollow rod 220, and the spindle axial bore (not shown) to the roller bearings 181. Also fixed about the rod 220 at its distal end is a ring-like stop member 222 which moves between the distal end of the spindle 195 and the knob 218, as illustrated, to limit the range of axial movement of the plate cylinder 55.

With reference to FIG. 13 and FIG. 1, the earlier-discussed interlock control system for ensuring safe operation of the press of the present invention will now be discussed in further detail. FIG. 13 is a generally schematic diagram of the interlock control system in accordance which the invention with incorporates the earlier noted switching means 19, 21, 23, 30, 32, 37, as geometrically located and as functionally described with regard to FIG. 1. The interlock system includes a conventional pair of power lines 300, 302. Extending across the power lines 300,302 in parallel relation for electrical energization are a press motor 305 and a paper handling vacuum pump 307. Electrically connected between the power lines 300,302, and in series with the press motor 305, is a fuse 306 of the conventional type and a set of normally open relay contacts 304. It can be seen that power will be applied to the press motor 305 when the normally open contacts 304 are closed. In likewise fashion, a set of normally open relay contacts 308 are provided in series with the vacuum pump 307 wherein closing of the contacts 308 applies power to the pump 307, the vacuum pump providing paper to the printer head 16 (FIG. 1) from the paper feed input 12. The operation of the vacuum pump 307 and its utilization in the paper feed input 12 are well-known in the art. Also connected across the power lines 300, 302 are a motor control circuit 320 and a vacuum pump control circuit 340.

The motor control circuit 320 includes, in serial relation and in electrical series relationship between the power lines 300, 302, the paper delivery interlock switch means 19, a carriage/printer head interlock switch means 322 which includes switching means 35, 36, 37, the other paper delivery interlock switch means 21, the printer head movable cover interlock switch means 30, 32, an on-off rocker switch 325, and a motor relay 330.

In operation, the rocker switch 325, having two sets of serially connected contacts 326, 327 and illustrated in its at-rest position, is momentarily switched by the operator to an on condition wherein the set of contacts 327 close. If all of the press interlock switch means (19,322,21,30,32), disregarding switch means 23, are in their proper condition, as will be subsequently explained, power is applied to the press motor relay 330. Upon power actuation to the press motor relay 330, the set of press motor contacts 304 are closed to apply power to the press motor 305. Also closed by the actuation of the relay 330 are a set of latching contacts 328 which parallel and bridge the contacts 327, which, after being momentarily closed by the operator, are returned to the position illustrated such that the contacts 327 are opened and the latching contacts 328 are closed or latched. The relay continues to be powered and to maintain the motor contacts 304 in a closed condition for press motor energization. To turn off the press motor, the operator need only push the rocker switch 325 to its off position wherein the contacts 326 are momentarily open to deenergize the relay 330 and to open the latching contacts 328 and the motor contacts 304. Return of the contacts 326 to their illustrated at-rest, closed position will not affect the deenergized condition of the press, since both sets of contacts 327 and 328 are now open.

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The functioning of the various safety interlock switches within the press motor control 320 will now be discussed.

With the press in an on condition, with the relay 330 being energized via the closed latching contacts 328, the press will continue to run unless an unsafe condition is presented in the form of, for example, an open condition of any of the covers 15, 17, 24 or 26, as earlier explained with respect to FIG. 1. The opening of the noted covers during an operating condition of the press would actuate their respective interlock switches 19, 21, 30 or 32 to an open circuit condition. Opening of any of these series of connected interlock switches 19,21,30,32 will deenergize the relay 330 and shut down the press motor 305 due to the opening of contacts 304, as explained earlier. With regard to the series-connected carriage/printer head interlock control 322, the printer head interlock switch means 37 switches between its two illustrated positions as a function of translational movement of the second plate cylinder to (engagement) and away from (disengagement) of the blanket cylinder. The carriage interlock switches 35 and 36, on the other hand, are actuated in accordance with the degree of carriage movement away from the printer head. The switch means 35, 36, 37 cooperate together to limit operator access to the moving plate cylinder when it is turning as a result of engagement with the blanket cylinder and actuation of the press motor 305. With the carriage at its engaged position and with the second plate cylinder engaged with the blanket cylinder, switch 37 is positioned as illustrated in FIG. 13, switching means 36 is closed, and switching means 35 is open. Under these switch conditions, the press motor operates in a normal manner. With the carriage moved to its disengaged position 105 (FIG. 4) the switch means 36 opens and the press motor will not operate until the second plate cylinder is shifted translationally away from and out of engagement with the blanket cylinder. Such shifting of the second plate cylinder throws the switch 37 from the position shown in FIG. 13 to its other position wherein it is in series with switch means 35, which is now closed as a result of carriage movement away from the printer head to the disengagement position. At the wash-up position 106 (FIG. 4) of the carriage, switch means 26 is open and switch means 35 is closed. Press motor actuation for driving of the carriage dampening and inking rollers 80 (FIG. 4) for wash-up purposes can only occur when interlock switch means 37 is in its other position, i.e., when it is actuated by translational movement of the second plate cylinder away from the blanket cylinder so that the cylinder will not rotate, thus exposing the operator to an unsafe position. Finally, when the carriage is moved all the way back to its lock-back position 107, both carriage interlock switch means 35, 36 are in an open circuit condition and the press motor will not operate regardless of the position of the plate cylinder actuated interlock switch means 37. Thus, it can be seen that the press motor interlock switch means 320 provides quick deenergization of the press whenever an unsafe operating condition, as earlier discussed, exists.

Turning to the vacuum pump control circuit 340, a second relay 345 is connected between the power lines 300 and 302 via a series-connected second rocker switch means 346 and the bin overload interlock switch means 23. The rocker switch means 346 functions in the manner similar to that as earlier explained with regard to rocker switch 325, wherein moving of the rocker switch 346 to an on position energizes the vacuum pump relay 345 and its latching contacts 347, and vacuum pump contacts 308, which in turn energize the vacuum pump 307. When an overload condition within the bin 30 (FIG. 1) is sensed by the interlock switch means 23, opening of interlock switch 23 deenergizes the vacuum pump relay 345, which in turn opens contacts 308 and 347. Reenergization of the vacuum pump motor 307 requires that the operator once again momentarily move the rocker switch 346 to its on condition after the printed paper has been removed from the bin 30 (FIG. 1) to reset the interlock switch means to a closed position.

Although a preferred embodiment of this invention is illustrated, it should be understood that various modifications and rearrangements of parts may be resorted to without departing from the scope of the invention disclosed and claimed herein.

What is claimed is:

1. An offset printing press comprising:

a mainframe including paper handling means, the paper handling means defining a paper handling path extending between a paper feed input and a paper delivery output;

a printer head mounted on and fixed to the mainframe and engageable with the paper handling path at a location generally intermediate the paper feed input and the paper delivery output, the printer head including a single blanket cylinder and a pair of plate cylinders, the plate cylinders being simultaneously engageable with the blanket cylinder, the plate cylinders and blanket cylinder being adjacent to each other and rotatably mounted on the printer head along generally parallel axes, the blanket cylinder being adapted to simultaneously transfer images from the plate cylinders to paper provided by the paper handling means;

a movable carriage mounted on the mainframe and located generally adjacent to the printer head, the carriage being substantially linearly movable along a generally straight line to and from the printer head, the carriage having a rectangular base including four linear motion ball bushings and located at a respective one of the four corners of the rectangular base, the mainframe including a pair of parallel rails upon which the ball bushings ride, the ball bushings engaging the rails to substantially eliminate carriage movement in directions generally perpendicular to the straight line along which the carriage moves, the carriage being positively lockable at predetermined positions along the generally straight line of linear movement;

a first set of dampening and inking rollers rotatably mounted on and fixed to the printer head and engageable with one of the plate cylinders; and

a second set of dampening and inking rollers rotatably mounted on and fixed to the carriage and engageable with the other of the plate cylinders when the carriage is moved toward the printer head to an engagement position.

2. An offset printing press according to claim 1, wherein the rails are circular cross sectional rods supported along substantially their entire lengths by the mainframe.

* * * * *

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United States Patent [19]

Butler et al.

[11] 4,270,483

[45] Jun. 2, 1981

[54] PRINTING COATER

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[22] Filed: Dec. 26, 1978

[51] Int. Cl.[3] B05C 11/00

[52] U.S. Cl. 118/46; 101/217; 118/206; 118/258; 118/262; 118/264; 118/261

[58] Field of Search 118/258, 46, 264, 206, 118/261, 262; 101/201, 451, 217

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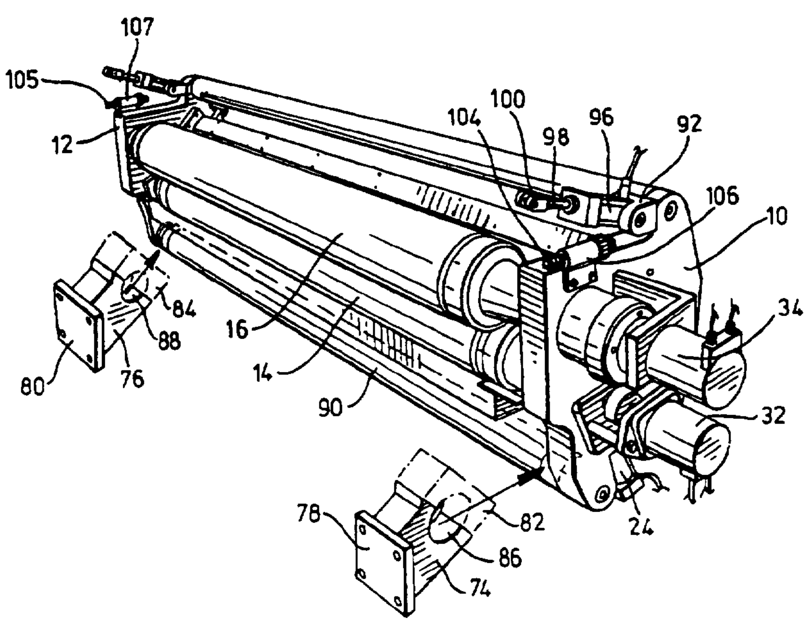
Primary Examiner—Edward C. Kimlin

[57] ABSTRACT

An apparatus is provided for attachment to the downstream end of a conventional offset lithographic printing press for in-line coating of the printed work issuing from the press, with water-based polymer coatings, to protect the printing ink as the printed matter sets and hardens. The apparatus includes a pick-up roller which picks up liquid coating composition from a reservoir structure, a cylindrical applicator roller to which the coating composition is transferred, the apparatus being mounted on the frame of the press so that the applicator roller of the apparatus can bear against the blanket roll of the printing press and transfer the coating composition to the blanket roll as the press operates. The apparatus is releasably mounted to the press, and can be pivoted about a lower axis to bring the applicator roll into and out of contact with the blanket roll of the press.

6 Claims, 5 Drawing Figures



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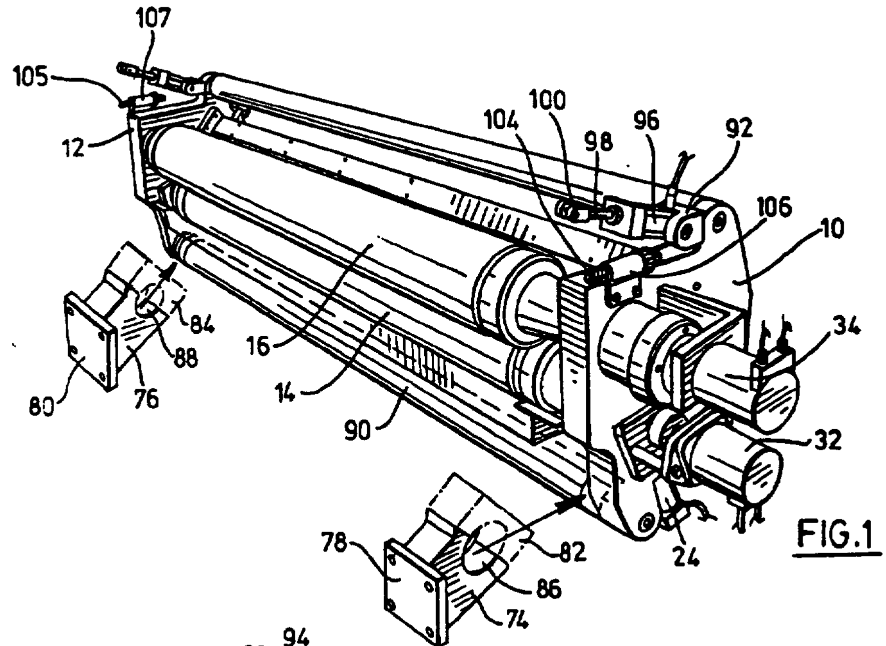
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FIG.1

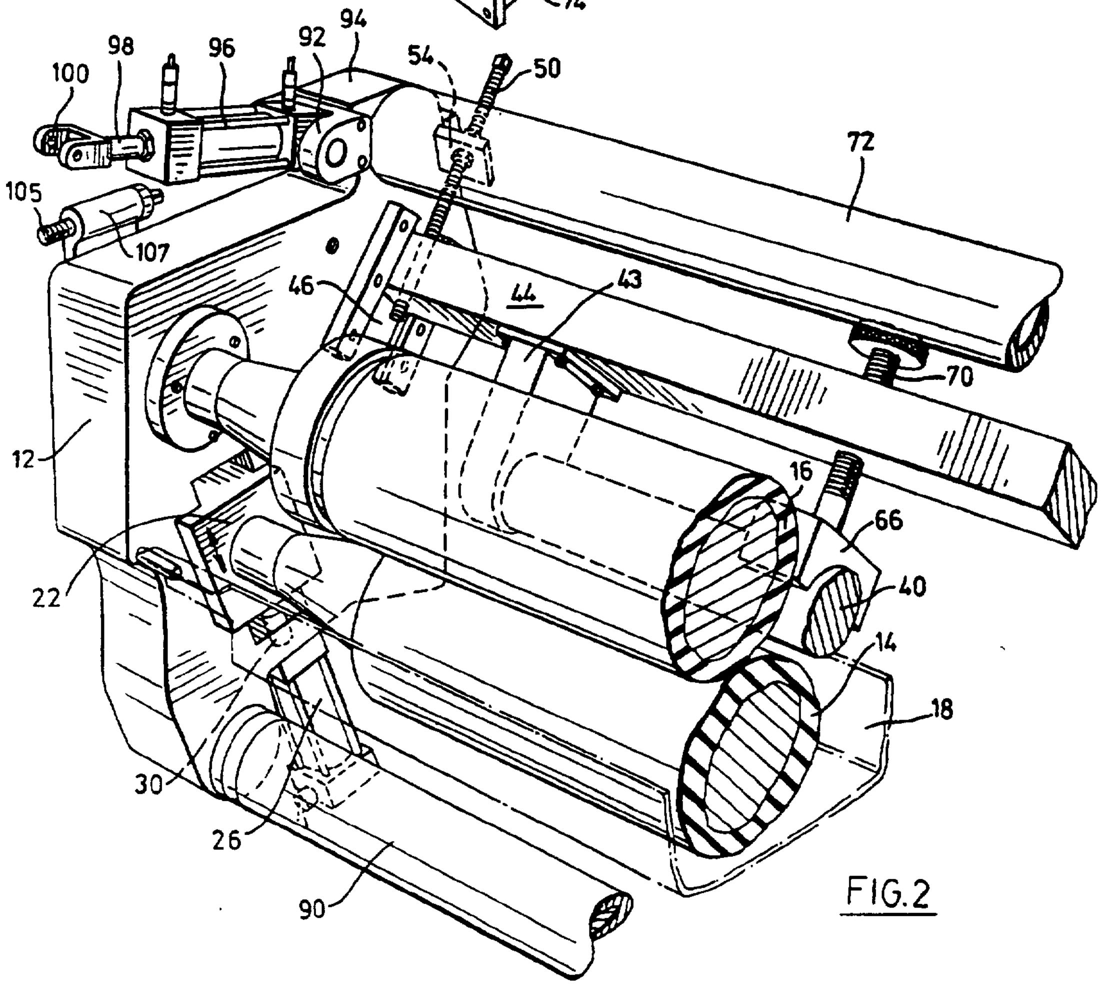
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FIG.2

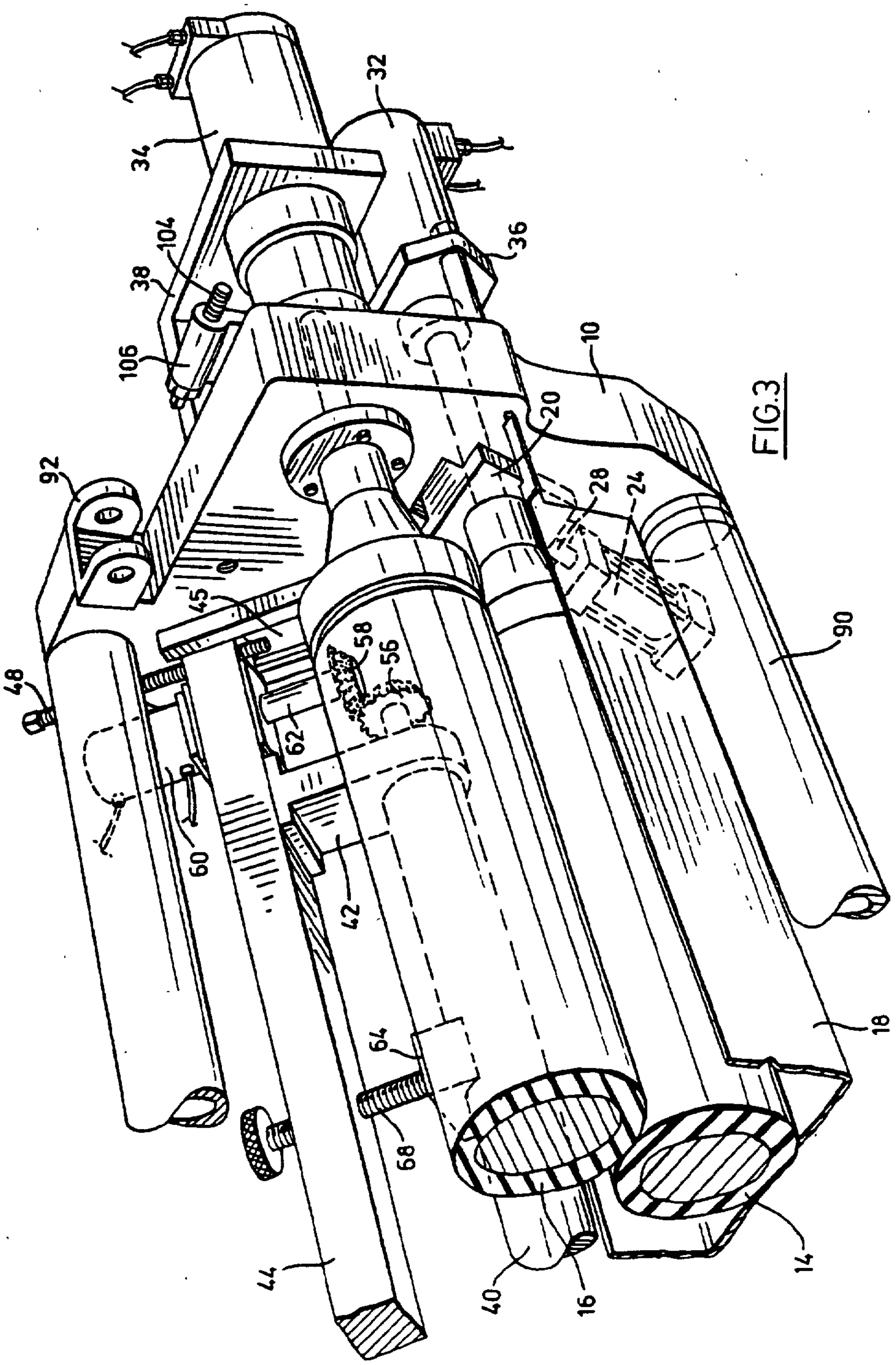

FIG.3

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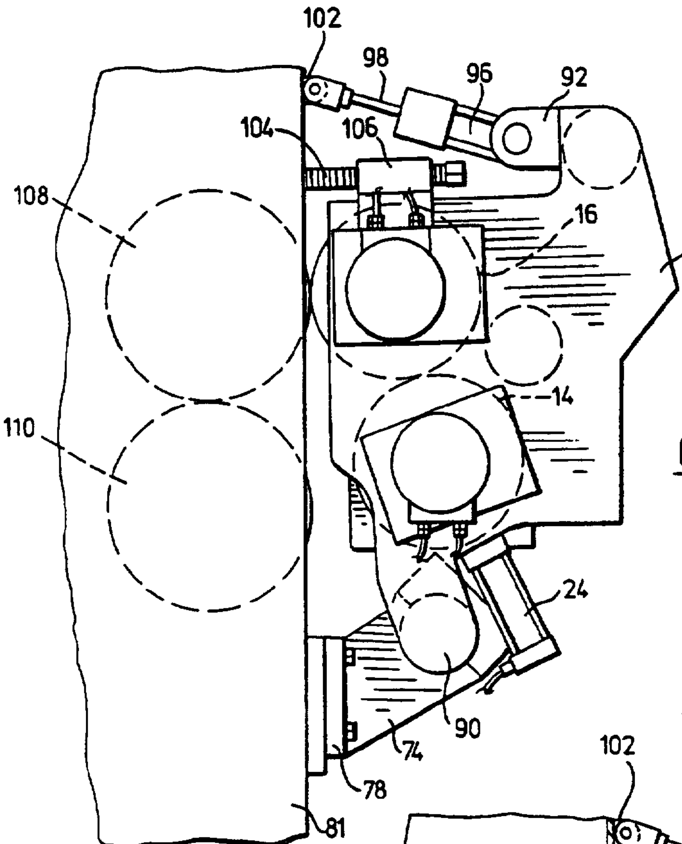
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FIG.4

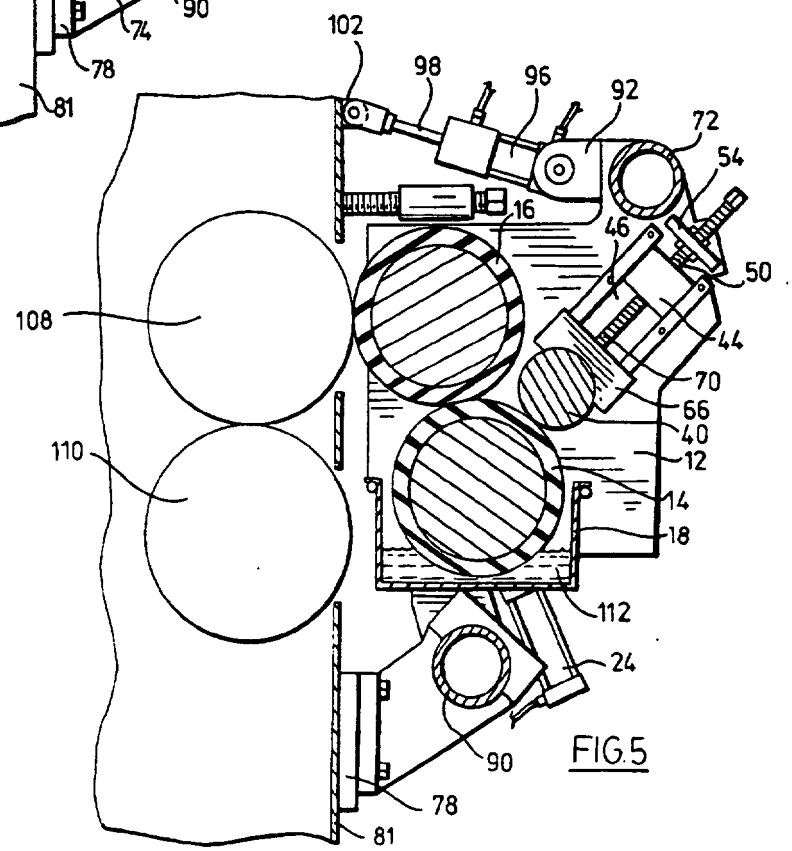
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FIG.5

PRINTING COATER

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to offset lithographic printing, and more particularly to apparatus for attachment to the down-stream end of an offset lithographic printing press, for coating purposes.

In offset lithographic printing, each printing stage includes a plate cylinder, to which the printing plates are fastened tightly around the circumference, the plate cylinder being equipped with superimposed inking, watering and wiping mechanisms. The plate cylinder does not come into contact with the paper to be printed, but transfers the image to an intermediate blanket cylinder, which has a specially composed smooth, rubber blanket surface. The blanket cylinder, having received the impression from the plate cylinder, in turn transfers it, or offsets it, onto the paper or other material, whilst it is being carried around an impression cylinder, located out of contact with the plate cylinder. Lithographic inks are oil-based, and special precautions normally need to be taken to dry the inks after their application to the printed material, as rapidly as possible without spoiling the quality of the printing, so that the printed material can be subsequently handled and stacked without damaging the applied printing.

2. Brief Description of the Prior Art

An alternative to conventional drying of printed sheets issuing from a lithographic printing press, is coating of the printed sheet with a water-borne system, to provide either a gloss or dull coating. Water-borne coatings, applied as an aqueous solution or emulsion, are capable of providing a simple protective barrier for the ink, which eliminates the need for the application of spray powder for drying purposes, and protects the ink from abuse whilst its normal setting and oxidation functions proceed. Much development with water soluble polymers has been undertaken in the last few years, to produce acceptable coatings for this purpose. When properly applied, the film is permeable and permits the passage therethrough of oxygen, to permit the normal setting and drying of the ink. In addition to this function of protecting printing inks after application to permit their proper drying, water-borne coatings can perform a useful decorative function to enhance the appearance of high quality, multi-colour printing work, for example phonograph record sleeves.

If the coating of printed material is conducted in a separate operation, after the material has been removed and isolated from the printing press, the operation is expensive and inconvenient, and does not contribute to the solution of the ink drying problems. It is known to apply water-borne and organic solvent lacquers in a separate operation from the printing, to provide special, decorative finishes. The use of solvent based lacquers introduces fire and explosion hazards

There is a need in the industry for a simple and economical apparatus for application of water-based polymer coatings to printed material immediately after the printing thereof, i.e. in-line coating with the lithographic offset press.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a novel apparatus for inline coating of printed material issuing from an offset lithographic printing press.

It is a further object of the invention to provide such an apparatus which can be releasably secured to an existing offset lithographic printing press, and operated in conjunction therewith without requiring substantial modification of the printing press itself.

The present invention provides an apparatus for application of coatings to printed material, in the form of an attachment to be applied to the downstream end of a conventional offset lithographic printing press. The apparatus is releasably mountable in position so as to apply a liquid coating composition to the blanket cylinder of the final stage of an offset press, the apparatus including an applicator roller which can bear against the surface of the blanket cylinder and rotate therewith, a pick-up roller which applies coating composition to the applicator roller for transfer to the blanket cylinder, and a reservoir of coating composition in which the pick-up roller runs, to obtain its source of coating material. The entire apparatus is constructed as a unit, for application and use with a standard printing press as and when required, and removable therefrom when not in use. It is merely necessary to disconnect the normal liquid supply train associated with the final stage of the press, without even physically removing it from the press, in order to use the apparatus according to the present invention along with a conventional press.

Thus according to one aspect of the present invention, there is provided an in-line coating apparatus for attachment to and use in conjunction with an offset lithographic printing press which has a final stage including a rotatable blanket cylinder and a rotatable impression cylinder, said apparatus being adapted for continuous surface coating of items printed by said press, said coating apparatus comprising:

a reservoir structure for receiving liquid coating compositions;

a cylindrical pick-up roller adapted to receive on its surface coating composition from said reservoir structure as it rotates;

a cylindrical applicator roller mounted to rotate with its surface contacting the rotating surface of said pick-up roller so as to transfer liquid coating composition from the pick-up roller to the applicator roller;

drive means for rotatably driving at least one of said pick-up roller and said applicator roller;

releasable mounting means for releasably securing said apparatus to the downstream end of said offset printing press, said mounting means being adapted to secure the apparatus to the press with surface contact between the applicator roller and the final stage blanket cylinder of said press.

From another aspect, the present invention provides an offset lithographic printing press having a plurality of liquid applicator stages, each including a rotatable blanket cylinder and a rotatable impression cylinder, said press including an in-line coating apparatus secured to the down-stream end thereof and operable in conjunction with the blanket cylinder of the final, downstream stage thereof, the coating apparatus including:

a reservoir structure for receiving liquid coating compositions,

a cylindrical pick-up roller adapted to receive on its surface coating composition from said reservoir structure as it rotates;

a cylindrical applicator roller mounted to rotate with its surface at one location contacting the rotating surface of said pick-up roller so as to transfer liquid coating composition from the pick-up roller to the applicator roller, said cylindrical applicator roller also mounted to rotate with its surface at the second location contacting the rotating surface of the blanket cylinder of the final stage of the press;

drive means for rotatably driving at least one of said pick-up roller and said applicator roller.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

A conventional offset lithographic printing press has at least two stages, and may have four or five stages, when the machine is used for printing several colours. The final stage of such a printing press normally includes a plate cylinder, a blanket cylinder and an impression cylinder, mounted substantially vertically one above the other, with a varnish trough and a train of vertically mounted rollers from the varnish trough downwardly to the plate cylinder, for applying varnish to the printed work as it proceeds out of the printing press. The apparatus according to the present invention is particularly well suited for securing to a printing press of this type. It is then merely necessary to disconnect the roller train between the varnish trough and the plate cylinder, e.g. by removing or displacing one of the rollers of said train, and the apparatus of the present invention can be used in its stead. The apparatus is equally applicable to a final ink-applying stage of an offset press, in similar manner.

Preferably also, the apparatus according to the invention includes a metering roller mounted adjacent to the surface of the pick-up roller, at a location where its surface carries the coating composition to transfer to the applicator roller, so that the metering roller may limit the quantity of coating composition carried by the pick-up roller. It is of advantage also to make the position of the metering roller adjustable, so that the amount of coating applied can be adjusted thereby.

Also according to a preferred embodiment, the apparatus is pivotally mounted with respect to the frame of the printing machine, and is pivotal about a generally horizontal axis located below the level of the blanket cylinder of the press and the pick-up roller of the coating apparatus. Then the apparatus can be pivoted towards and away from the end of the printing press, to put the applicator roller into contact with the blanket cylinder for operating purposes, and to move the applicator roller out of contact with the blanket cylinder, when it is not required to use the coating attachment according to the invention. Such an arrangement greatly enhances the versatility of the resulting printing press, allowing it to be used in conventional manner as well as in application of coating by the apparatus of the invention.

BRIEF REFERENCE TO THE DRAWINGS

FIG. 1 is a perspective view of an in-line coating apparatus according to the present invention;

FIG. 2 is a detailed perspective view of the first, left hand end of the apparatus of FIG. 1,

FIG. 3 is a detailed perspective view of the second, right-hand end of the apparatus of FIG. 1,

FIG. 4 is an end view of the apparatus of FIG. 1, taken from beyond the left-hand end thereof;

FIG. 5 is a vertical cross-sectional view of the apparatus of FIG. 4.

In the drawings, like reference numerals indicate like parts.

DETAILED DESCRIPTION OF THE SPECIFIC PREFERRED EMBODIMENT

With respect to the drawings, and especially to FIGS. 1, 2 and 3 thereof, an in-line coating apparatus especially for applying water-borne liquid coating compositions to printed sheet or web material, comprises a pair of similar end frame members 10, 12 in which are journalled shafts of the cylindrical pick-up roller 14 and a cylindrical applicator roller 16, mounted above the pick-up roller 14. A reservoir structure in the form of an open-topped trough 18 is provided, in which coating liquid may be contained, and extending between the frame members 10, 12. The pick-up roller 14 is mounted to rotate in the trough 18. The applicator roller 16 and the pick-up roller 14 have surface contact near the top of the pick-up roller 14. The position of pick-up roller 14 is adjustable to a limited extent, towards and away from the applicator roller 16 and relative to the bottom of the trough 18, by slidable journal blocks 20, 22 slidably mounted in apertures in respective end frame members 10, 12. The journal blocks 20, 22 are positionally adjustable in end frame members 10, 12 by means of respective hydraulic cylinders 24, 26 with pistons 28, 30 protruding upwardly therefrom and passing upwardly through apertures in frame members 10, 12 to bear against the underside of the journal blocks 20, 22. The cylinders 24, 26 are connected to a suitable source of hydraulic power, not shown.

The shafts of the pick-up roller 14 and applicator roller 16 are each provided with respective hydraulic motors 32, 34, for rotational drive of the rollers. The motors 32, 34 are mounted in respective structural brackets 36, 38 protruding axially beyond side frame member 10 and secured thereto.

A cylindrical rotatable metering rod 40 is provided, extending parallel to the pick-up roller 14 and applicator roller 16, and rotatably mounted in bearing blocks 42, 43 one at each end of metering rod 40. The bearing blocks are securely bolted to a mounting bar 44 which at each end is slidably received in slideways 45, 46 on the inner surfaces of respective end frame members 10, 12. The slideways are directed radially towards the pick-up roller 14 so that the proximity of metering rod 40 to pick-up roller 14 is adjustable by adjusting the position of mounting bar 44 in slideways 45, 46. To effect this adjustment, screw shafts 48, 50 are provided, threadably engaging brackets such as 54, on respective end frame members 10, 12, and received in mounting bar 44. Metering rod 40 is driven for rotation by means of bevel gears 56, 58 and hydraulic motor 60 with drive shaft 62, mounted on mounting bar 44. The metering rod 40 is steadied and guided in its rotation by adjustable guide blocks 64, 66, the end, part cylindrical surface of which slidably engages the circumference of rod 40. The guide blocks 64, 66 ensure an even coating thickness across the width of the press. They serve to minimize coating thickness variance caused by roller sag along its considerable length, or deflection thereof due to mechanical problems. The guide blocks 64, 66 are mounted on the end of respective screw threaded bolts 68, 70 threadably received in apertures in mount-

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ing bar 44. Above the mounting bar 44, there is provided a tubular strengthening rail 72 extending between end frame members 10, 12.

The mounting means for releasably securing the coating apparatus to the downstream end of an offset printing press comprises a pair of similar clamps 74, 76 each provided with a plate 78, 80 to be bolted to upright end frames 81 of a printing press (FIGS. 4 and 5). Each clamp 74, 76 has a respective removable block 82, 84 defining a circular aperture 86, 88. There is provided a cylindrical mounting rod 90 on the apparatus, extending between the end frame members 10, 12 at the lowermost part thereof. The mounting rod 90 is received in circular apertures 86, 88 in the clamps to form a pivotal connection of the apparatus to the press at this lowermost part.

At its upper part, the apparatus is connected to the press by means of a pair of length adjustable linkages, one attached to each end of frame member 10, 12. Each linkage comprises a yoke 92 secured to an uppermost protrusion 94 on the respective end frame member 10, 12 (see especially FIG. 2), the yoke 92 having pivotally secured thereto a hydraulic cylinder 96 and piston 98, the end of piston 98 having a bifurcated formation 100 for pivotal securing to a bracket 102 on the end frame 81 of the press. Thus hydraulic cylinder 96 can be pressurized to extend piston 98 and cause pivoting of the coating apparatus relative to the frame 81 of the press, about the inner horizontal axis provided by the mounting rod 90. The forwardmost position of the pivoting movement of the apparatus towards the press frame 81 is limited, to an adjustable extent, by a stop means comprising a pair of bolts 104, 105 threadably received in respective threaded sleeve mounts 106, 107, one at each end frame member 10, 12 at the top surface thereof, the bolts 104, 105 protruding axially towards the end frame 81 of the press.

The mounting and operation of the apparatus of the present invention will be apparent from the foregoing description and particularly with reference to FIGS. 4 and 5 of the accompanying drawings. The apparatus is mounted in position on the end frame 81 of an offset lithographic printing press, the final, downstream stage of which includes a blanket cylinder 108 and impression cylinder 110, between which printed material is fed. The mounting is accomplished using releasable clamps 74, 76 pivotally engaging mounting rod 90, and by connecting bifurcated formations 100 on piston rods 98 to brackets 102. Coating liquid 112 is introduced into trough 18. The relative position of pick-up roller 14, applicator roller 16 and metering rod 40 are adjusted to provide the pick-up and transfer of coating liquid 12 in the desired amount. Hydraulic cylinders 96 are contracted to pivot the apparatus about rod 90 and bring applicator roller 16 into light surface contact with blanket cylinder 108 of the press. The contact pressure is limited by presetting the position of stop bolts 104, 105 in their respective sleeves 106, 107, to engage the end frame 81 of the press at the desired position. This prevents undue pressure on and consequent damage to the surface of the blanket cylinder 108. The various drive motors for the apparatus are activated to drive the rollers etc. at the desired speed to match that of the press. Coating liquid 112 is picked up from trough 18 by pick-up roller 14, metered by rod 40, transferred to applicator roll 16 by surface contact therewith, and thence similarly to the blanket cylinder 108 of the press to coat sheets printed by and issuing from the downstream end of the press. When it is desired to interrupt the application of coating, the hydraulic cylinders 96 may be pressurized to pivot the apparatus about rod 90, clockwise with reference to FIGS. 4 and 5, and bring applicator roller 16 out of surface contact with blanket cylinder 108. The printing press conventionally has a liquid trough and train of smooth surface transfer rollers located above the blanket cylinder and plate cylinder (not shown) thereof, for supply of other liquids such as varnishes to the printed sheet via the blanket cylinder. When the apparatus according to the invention is moved to its operative position shown in FIGS. 4 and 5, the conventional liquid application is rendered inoperative by interrupting the liquid supply roller train thereof. The conventional system can readily be replaced and used when the apparatus of the invention is not to be employed and is pivoted to its inoperative position or removed entirely from the press.

The apparatus according to the present invention thus provides a simple and versatile in-line coating means for use with conventional, standard offset lithographic printing presses. It is well suited for the application of water-based polymer coatings to newly printed work, to protect the ink thereon whilst it sets and hardens. It requires a minimum of modifications to the standard press and easily installed as an "add-on" item. It does not interfere with sheet feed and collection apparatus of the press, and can be used with conventional dryers if desired. Once installed it can be moved to an inoperative position simply and easily without total removal from the press if desired, and the press restored to its full conventional operation.

Whilst a specific preferred embodiment of an apparatus according to the invention has been described and illustrated in detail herein, it will be appreciated that this is for illustrative purposes only and is not to be construed as limiting. Many variations of standard parts, e.g. use of alternative drive means and power actuation means, will readily occur to those skilled in the art. The scope of the invention is defined by the appended claims.

What we claim is:

1. An in-line coating apparatus for attachment to and use in conjunction with an offset lithographic printing press which has a final printing stage including plate, blanket and impression cylinders, said blanket cylinder engaging with said impression cylinder to print a sheet passing between the blanket and impression cylinders, said apparatus being adapted for continuous surface coating of items printed by said press and passing in contact with said blanket cylinder of the final printing stage thereof, the coating apparatus comprising:

- a reservoir structure for receiving liquid coating compositions;
- a cylindrical pick-up roller adapted to receive on its surface coating composition from said reservoir structure as it rotates;
- a cylindrical applicator roller mounted to rotate with its surface contacting the rotating surface of said pick-up roller so as to transfer liquid coating composition from the pick-up roller to the applicator roller;
- drive means for rotatably driving at least one of said pick-up roller and said applicator roller;
- releasable mounting means to mount said apparatus adjacent the blanket cylinder of said final printing stage of said printing press, said mounting means being effective to secure the apparatus to the press

and including control means for moving the applicator roll independently of said blanket cylinder so that the blanket cylinder remains in engagement with said impression cylinder, between a first, operative position in which said applicator roll is in engagement with the blanket cylinder of the final printing stage of said press and a second, inoperative position in which said applicator roll is disengaged from said blanket cylinder, said control means constituting means permitting said final stage optionally to be used as a printing stage and as a coating stage.

2. The apparatus of claim 1 further including a metering roller mounted adjacent to the surface of the pick-up roller at a location where said surface carries coating composition to transfer to the applicator roller, said metering roller being adapted to limit the quantity of coating composition carried by the pick-up roller.

3. The apparatus of claim 2 wherein the metering roller is positionally adjustable, towards and away from the pick-up roller.

4. The apparatus of claim 3 including adjustment means for adjusting the relative positions of the pick-up roller and the applicator roller, to vary the surface contact pressure therebetween.

5. The apparatus of claim 1 wherein the releasable mounting means is a pivotal mounting means comprising a lower pivot mount for releasably attaching to a lower part of the frame of the printing press, said lower pivot mount being disposed below the pick-up roller and applicator roller, and an upper mount for releasable attachment to a higher part of the frame of the printing press, said upper mount being disposed above the applicator roller and comprising a length adjustable linkage, the length of said linkage being adjustable in a direction towards and away from the end of the printing press to cause pivoting of the apparatus relative to the printing press about said lower pivot mount, thereby bringing the applicator roller into and out of operative contact with the blanket cylinder of said printing press.

6. The apparatus of claim 5 also including an adjustable stop means mounted on the upper part thereof, adapted to engage the end frame of the printing press to limit the pivoting movement of the apparatus towards the end of the printing press when the applicator roller is brought into contact with the blanket cylinder.

* * * * *

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United States Patent [19]

Satterwhite

[11] **4,308,796**

[45] **Jan. 5, 1982**

[54] **OFFSET LITHOGRAPHIC PRESS WITH INK METERING SYSTEM FOR BLANKET CYLINDER**

[75] Inventor: **William L. Satterwhite**, Dallas, Tex.

[73] Assignee: **S-W-H, Ltd.**, St. Louis, Mo.

[21] Appl. No.: **57,327**

[22] Filed: **Jul. 13, 1979**

[51] **Int. Cl.**[3] **B41F 31/06**; B41F 31/12; B41F 31/36

[52] **U.S. Cl.** **101/143**; 101/144; 101/351; 101/352; 101/217; 118/261; 118/46

[58] **Field of Search** 101/350, 351, 352, 349, 101/363, 364, 348, 247, 206, 207, 208, 209, 210, 217, 218, 148, 142, 143, 144, 118/258, 46, 262, 263

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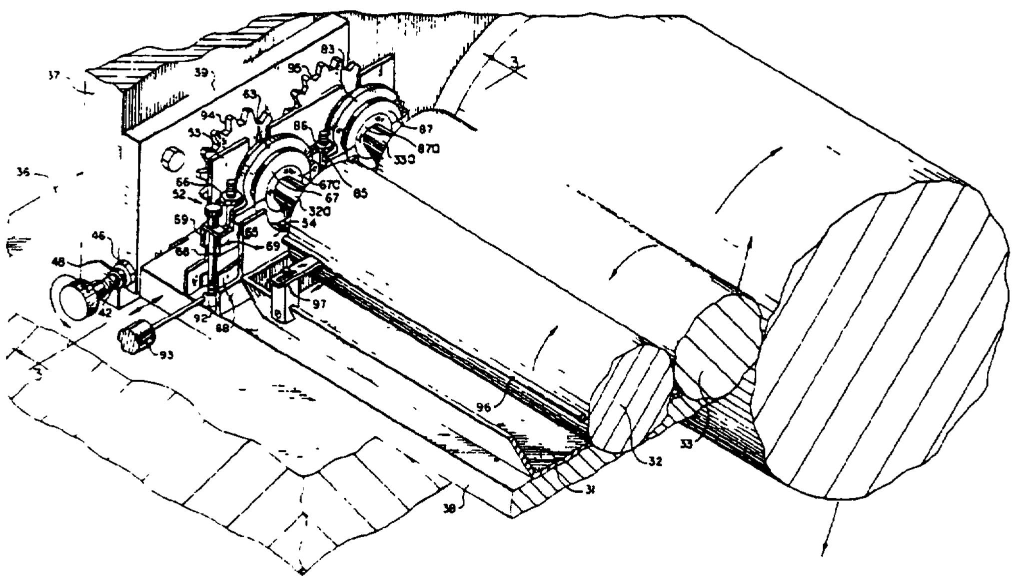
Primary Examiner—J. Reed Fisher
Attorney, Agent, or Firm—Thomas L. Cantrell; Joseph H. Schley; Stanley R. Moore

[57] **ABSTRACT**

Disclosed are improved methods and apparatus for printing, including equipment for adapting an offset press so that it may be operated flexographically, either to coat stock or print on it, without impairing the function of the press as an offset press. In addition, the equipment improves the application of two-part inks or catalyst set inks and permits simultaneous printing and coating of stock. The equipment includes a pair of rollers and an ink pan, as well as drive means for the rollers, and mounting means for bringing one of the rollers into ink transfer contact with the blanket roll of an offset press. The mounting means includes quick-release collars for easy removal of the rollers from the press when they are not needed, and for maintenance.

4 Claims, 7 Drawing Figures



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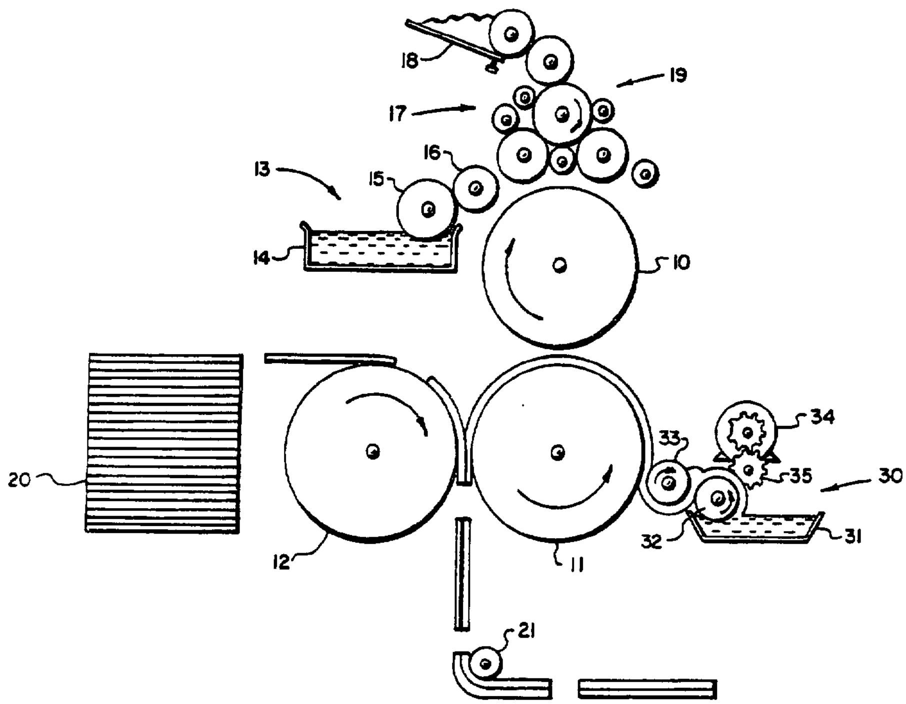
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FIG. 1

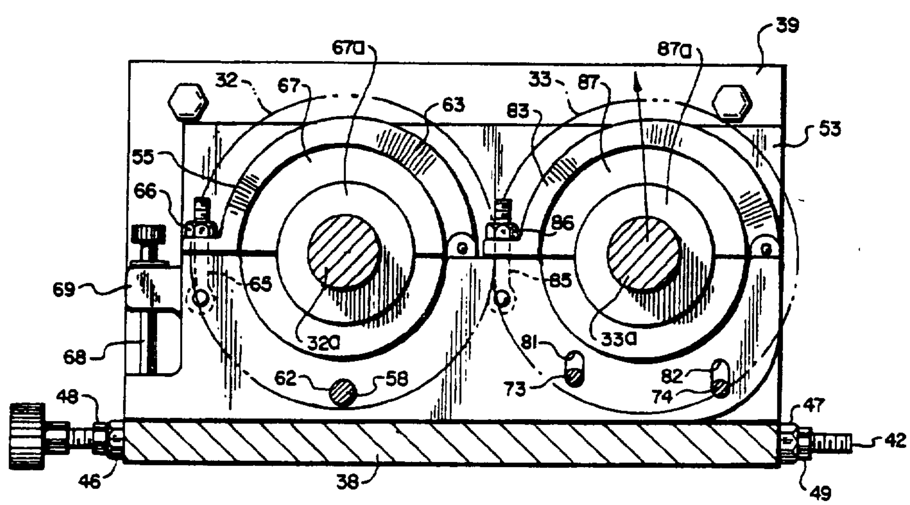
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FIG. 3

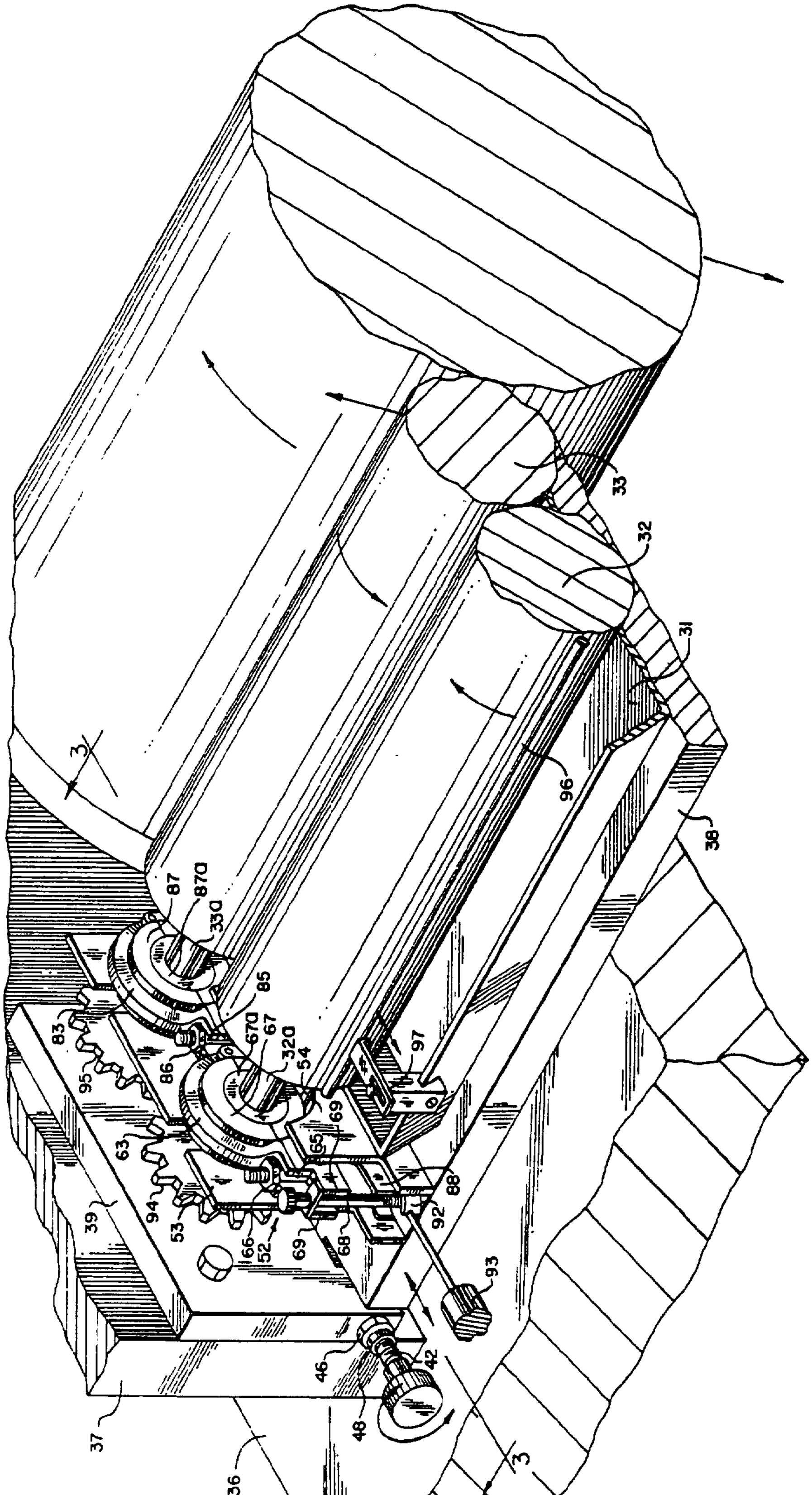
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FIG. 2

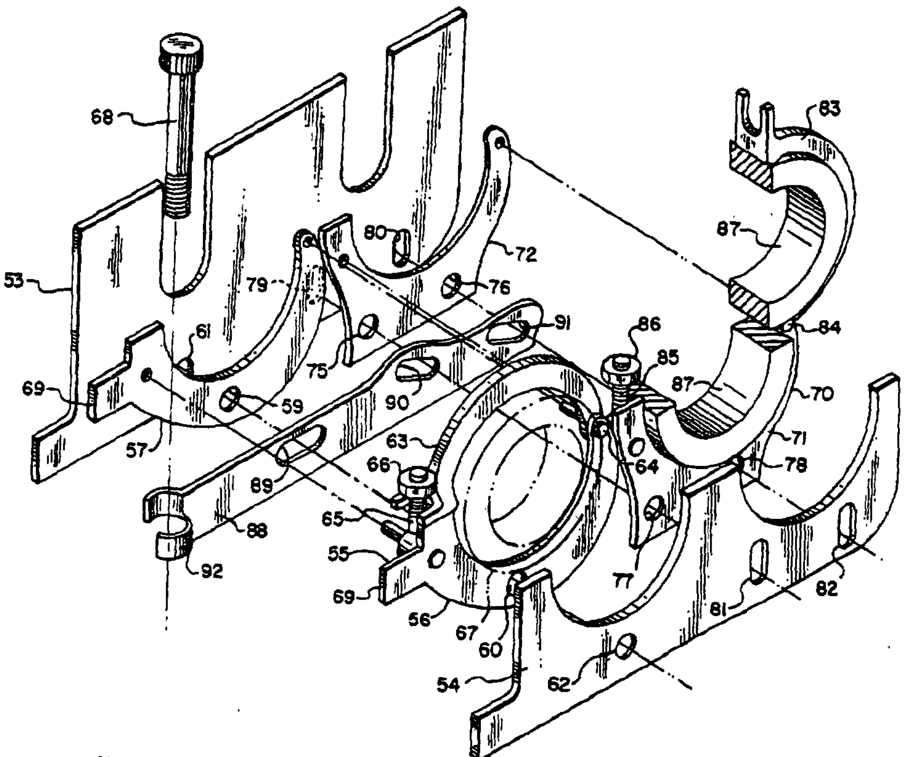
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FIG. 4

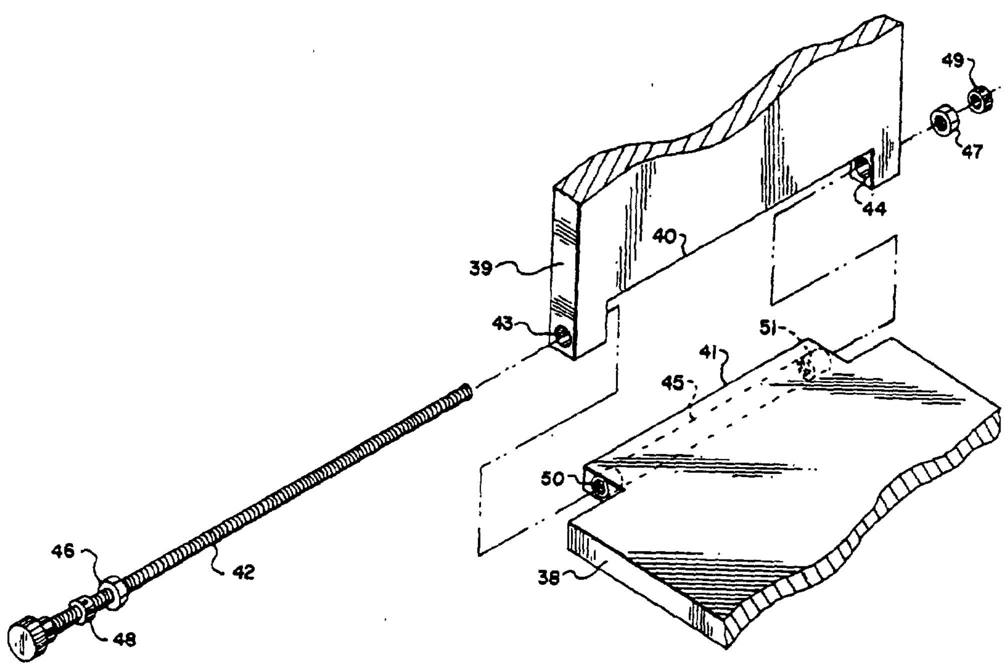
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FIG. 5

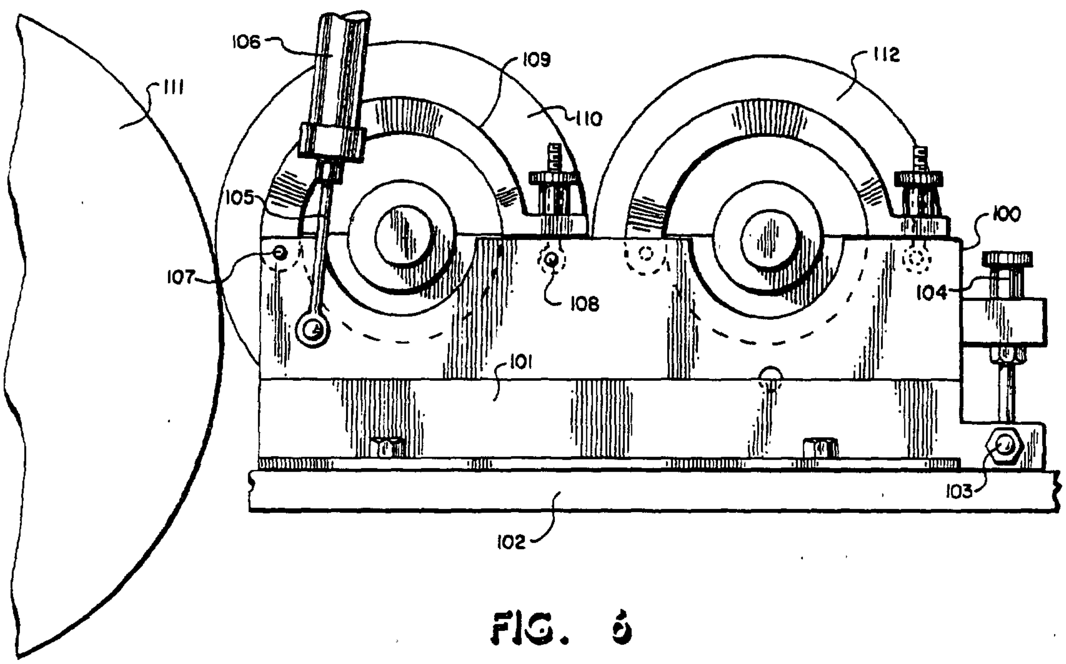
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FIG. 6

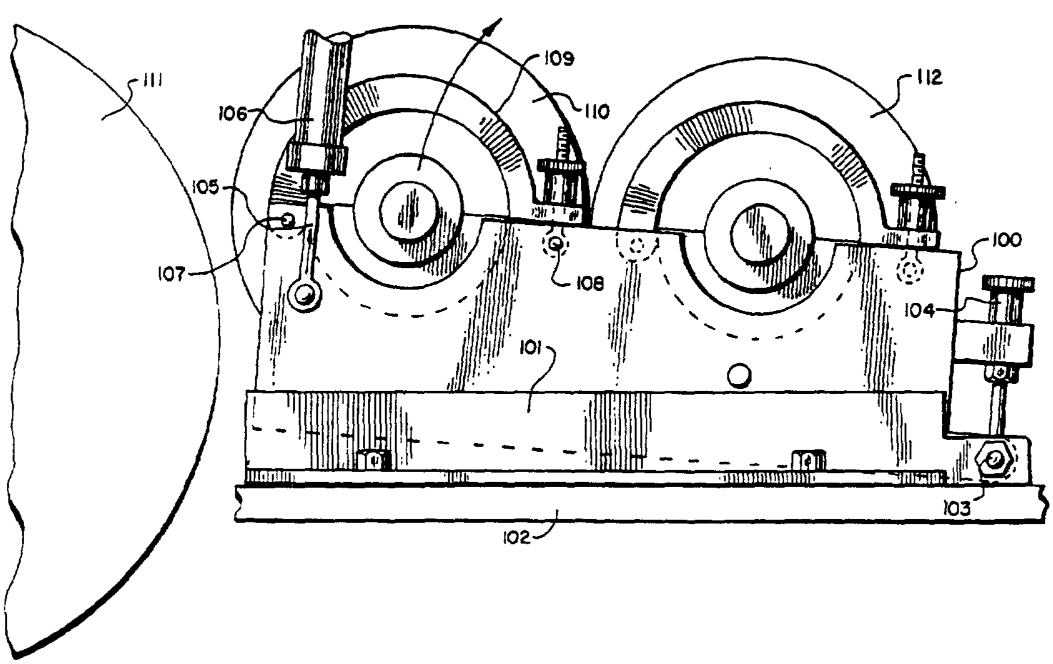
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FIG. 7

OFFSET LITHOGRAPHIC PRESS WITH INK METERING SYSTEM FOR BLANKET CYLINDER

BACKGROUND OF THE INVENTION

Offset lithographic printing is a method employing a plate cylinder which carries a planographic printing plate, whose image and non-image portions are substantially coplanar, the image area being hydrophobic and the non-image area being hydrophilic. A dampening system applies aqueous solution to the non-image areas of the plate, and an inking system applies a greasy ink to the image portions. The thus coated plate is rotated into contact with a resiliently surfaced blanket cylinder, thereby transferring the ink (and dampening solution) from the plate cylinder to the blanket cylinder. Printing stock, in either sheet or web form, is fed against the blanket cylinder by an impression cylinder, and the ink (and dampening solution) is transferred to the stock, thus completing the printing operation except for any heat-drying which may be employed.

Flexographic printing represents a different approach than offset printing, and its most common applications involve printing on web stock employed in packaging, such as corrugated stock, plastic, etc. Printing plates are employed in which the image areas are raised with respect to the non-image areas, rather than being co-planar with them. There is no blanket cylinder, and the plate cylinder comes into direct contact with the stock, which is delivered against it by an impression cylinder. Ink is applied to the image areas of the plate by rollers working in an ink pan adjacent the plate cylinder.

Each of these two methods of printing has its own set of advantages and disadvantages, but as the art has developed thus far, it has not been possible to operate both methods on a single press, using whichever is most advantageous for a given job. In the art of offset printing, techniques of sheet feeding are highly developed, while, as pointed out above, web feed is normative for flexographic presses, and the advantages of flexographic printing are largely foregone in sheet-fed applications.

In the field of offset printing, development work is being done on catalyst-set inks and other two-part ink systems. One difficulty with catalytic systems is the tendency of the catalyst to back-migrate from its point of application to the plate cylinder into the ink fountain, where it causes premature setting of the ink.

In some printing applications, it is desirable to coat the stock with a varnish or other coating after the printing has been applied, instead of printing on top of stock precoated by the paper manufacturer. For such applications, printing houses have a need for equipment capable of applying a suitable over-coating to printed stock. Preferably, such equipment should be capable of applying the coating simultaneously with the printing, but in any event, it should be capable of applying the coating in a separate step.

SUMMARY OF THE INVENTION

The present invention addresses the problems and needs just outlined. In accordance with the present invention, equipment is provided for mounting on an offset press for feeding ink, ink component, coating material, or another liquid directly to the blanket roll of the press The equipment of the invention includes an ink fountain, at least a pair of rolls mounted to work in the fountain to pick up ink therefrom, means for moving one of said rolls into and out of ink transferring contact with a blanket roll, driving means for the rolls, and means for mounting these parts on an offset press adjacent its blanket roll, and for adjusting and aligning their position with respect to the blanket roll. In its preferred form, the mounting means includes quick release collars enabling easy removal of the rolls of the invention from the press for cleaning and maintenance, and so they will be out of the way when the press is used in operations not involving their use.

As those with ordinary skill in the art know well, offset presses are and have been produced in many different sizes and configurations. The equipment of the invention is made up of standardized components which, in most instances, may be readily adapted to presses of many different configurations with little or no change in any given component.

The rolls employed in the invention may have surfaces of various kinds which are effective for picking up and transferring ink, and need not have identical surfaces. For example, one roll may be rubber coated, while the other may be etched metal. The drive system for the rolls is preferably through a motor independent of the motor driving the rolls of the press, and it is preferred that a variable speed control be provided so that the rolls of the invention may be driven at selected surface speeds with respect to the surface speed of the blanket roll. In this way an additional means of controlling the transfer of ink to the blanket roll is provided, since the relative surface speeds of the blanket and transfer rolls determine the degree of scrubbing action between the two, and the intensity of the scrubbing action influences the thickness of the ink film transferred.

The equipment of the invention, when associated with an otherwise conventional offset press, materially increases the versatility of the press, and makes possible practice of the several method aspects of the invention.

A conventional offset press, with the equipment of the invention mounted thereon, may be operated as a paper coater by placing a fully exposed photosensitive plate on the blanket roll, thereby effectively converting it to a plate cylinder positioned in the same relative position as the plate cylinder of a flexographic press, that is, working against the impression cylinder. The true plate cylinder is disengaged from the thus converted blanket roll, and may even be removed from the press if desired. (The disengagement or removal of the plate cylinder also effectively disengages the dampening and inking systems associated with that cylinder.)

The ink fountain of the equipment of the invention is then loaded with coating material, and the transfer roll is positioned to work against the blanket roll which has been converted to a plate cylinder, at a selected relative surface speed. The blanket roll is placed in rotation, and stock to be coated (in either sheet or web form, depending on the press) is fed against the rotating blanket roll by the impression cylinder. Coating material is thus fed from the fountain to the transfer roll, from that roll to the plate on the blanket roll, and then from that plate to the stock.

The equipment of the invention is especially well adapted for applying water base acrylic or polyurethane coating materials, which are safer and more desirable environmentally in the press room, and which make possible water clean-up, thus saving on petroleum based solvents.

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The fully exposed photosensitive plate which was used to convert the blanket roll to a plate cylinder may be replaced by a flexographic plate having raised image areas, and the coating material in the fountain of the equipment of the invention replaced with a flexographic type ink. The offset press in this condition is thereby made capable of printing flexographically when circumstances make it desirable to use this printing technique, with a far smaller capital investment than would be necessary to obtain a separate flexographic press.

When it is desired to operate the press as a conventional offset press, the coating plate or flexographic plate on the blanket roll is removed, and the transfer roll is moved out of working engagement with the blanket roll. If desired the transfer roll and pick-up roll may be removed from the press entirely. The plate cylinder is brought back into engagement with the blanket roll, and the press is thereby placed in condition to operate in the conventional offset manner.

When it is desired to conduct offset printing utilizing a catalyst set ink, the press is set up in the conventional offset manner, but with the transfer roll of the equipment of the invention positioned to work against the blanket roll. The primary ink component is placed in the main ink fountain feeding ink to the plate cylinder. The catalyst bearing component is placed on the blanket roll by the transfer roll prior in time to the transfer of the primary ink component from the image areas of the plate cylinder to the blanket roll. The thus catalysed ink on the blanket roll is then transferred to the stock brought against the blanket roll by the impression cylinder.

Several important advantages are obtained in accordance with this aspect of the invention. The ink is catalysed on the blanket roll immediately prior to its transfer to the stock, instead of at some point up on the plate cylinder. This means that extremely quick setting inks may be employed, and the danger of the ink setting prematurely on the plate cylinder is substantially eliminated. Furthermore, since the catalyst component of the ink, and its point of application, are farther removed from the main ink fountain, the danger of significant back-migration of the catalyst component up into the main ink fountain is greatly reduced, if not completely eliminated.

Another advantage flowing from the use of catalyst-set ink is that the need for spraying anti-offset powder onto the freshly printed stock to prevent the sheets from sticking together is eliminated, thus improving the press room environment and making it safer.

When it is desired to coat stock simultaneously with the printing of it, the press is set up in conventional offset manner, except that coating material (and lithographic plate desensitizing material, such as phosphoric acid and gum arabic) is placed in the fountain of the equipment of the invention, and the transfer roll is positioned to work against the blanket roll. In accordance with this aspect of the invention, a layer of coating material is first placed on the blanket roll. Ink is then placed on top of it by the plate cylinder. When the blanket roll contacts the stock, the ink is transferred to the stock, with the coating material being transferred to the stock primarily on top of the ink, as well as over the non-image areas. In such operations careful attention must be given to balancing aqueous and oily materials both in the ink and varnish in accordance with good practice in the art.

From the foregoing it can also be seen that catalyst may be incorporated into the coating material, and a catalyst set ink employed in the simultaneous printing and coating operation.

From the foregoing, it can be seen that a major object of the present invention is to greatly increase the capabilities of offset presses by adding to them a relatively simple and inexpensive set of equipment.

In particular, it is an object of the invention to equip an offset press so that it may print in a flexographic mode when desired and yet be readily returnable to operation in the standard offset mode.

In addition, it is an object of the invention to equip an offset press so that is is capable of operation as a paper coater, coating over printing either simultaneously with the printing, or in a separate step.

Another object of the invention is to equip an offset press to better handle two part or catalyst set inks.

Still another object of the invention is to equip an offset press to simultaneously print with catalyst set ink and coat the stock over the printing.

In addition, it is an object of the invention to provide a set of equipment giving an offset press the above-described capabilities, which equipment is made up of standardized components readily adaptable to presses of many different sizes and configurations.

The manner in which the foregoing objects and purposes, together with other objects and purposes, are achieved can best be understood from a consideration of the detailed description which follows, together with the accompanying drawings.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a very diagrammatic side elevational view, with many standard structural parts omitted for the sake of clarity, of an offset press to which has been applied the equipment of the invention;

FIG. 2 is a fragmentary perspective view on an enlarged scale of one embodiment of the equipment of the invention, showing also a portion of an offset press on which it is mounted;

FIG. 3 is a sectional side elevational view of the mounting means for the metering roll and transfer roll employed in the embodiment of FIG. 2, the section being taken on line 3—3 of FIG. 2;

FIG. 4 is an exploded perspective view of a portion of the mounting means of FIG. 3;

FIG. 5 is an exploded perspective view of another portion of the mounting means of FIG. 3;

FIG. 6 is an end elevational view of another embodiment of mounting means for the metering and transfer rolls of the invention, showing the transfer roll in contact with an offset press blanket cylinder; and

FIG. 7 is an end elevational view similar to FIG. 6, showing the metering roll moved out of contact with the blanket cylinder.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Attention is first directed to FIG. 1, which shows a conventional offset press in very diagrammatic form. The primary components of the press which are of present interest are the plate cylinder **10**, blanket cylinder **11**, and impression cylinder **12**. Mounted adjacent the plate cylinder is a dampening system **13**, including a dampening fountain **14**, a metering roll **15**, and a dampening roll **16**. Also mounted adjacent the plate cylinder is an inking system **17**, including a paste ink fountain **18**

and a set of metering and transfer rolls 19. Various systems of metering and transfer rolls are in common use, and the roll set 19 in FIG. 1 is intended to be merely illustrative. A supply of printing stock 20 (shown as stacked sheets, but it may be a roll of web stock) is positioned to be fed, by conventional feeding means not shown in FIG. 1 to the impression cylinder 12.

The press as just described is conventional. In its conventional operation, a planographic plate is mounted in plate cylinder 10, which rotates clockwise as FIG. 1 is drawn. Aqueous dampening solution is applied to the hydrophilic non-image portions of the plate by the dampening system 13 as the plate is rotated past dampening roll 16. Greasy ink from fountain 18 is applied to the hydrophilic image portions of the plate by metering and transfer roll set 19. As the inked and dampened portion of the plate is further rotated, it comes into contact with the resilient surface of the blanket roll 11, which rotates counter-clockwise as FIG. 1 is drawn. The ink and dampening solution are transferred by this contact to the surface of the blanket roll.

Printing stock is fed from supply 20 onto clockwise rotating impression cylinder 12, which carries it through the nip between blanket cylinder 11 and impression cylinder 12. As the stock passes through this nip, the ink and dampening solution are transferred from the blanket cylinder to the stock, which is led away from the press by a take-off roll 21.

Conventionally, means are provided on an offset press such as that shown in FIG. 1 for moving the plate cylinder out of contact with the blanket cylinder for set-up, cleanup and maintenance purposes, and provision is also made for removing various rolls and cylinders from the press.

In FIG. 1, the equipment of the invention is shown as applied to the conventional offset press just described. It is designated generally as 30, and the components thereof appearing diagrammatically in FIG. 1 are ink fountain pan 31, metering roll 32, transfer roll 33, variable speed drive motor 34, and drive train 35. Drive motor 34 is preferably provided with a speed control so that the relative surface speeds of transfer roll 33 and blanket roll 11 may be established at desired values. A single metering roll 32 is shown in FIG. 1, but those skilled in the art will understand that multiple roll metering systems may be employed without departing from the scope of the invention.

The equipment of the invention 30 is shown in FIG. 1 as mounted on the offset press so that transfer roll 33 is in contact with blanket cylinder 11, and metering roll 32 is disposed in fountain 31 and in contact with transfer roll 33. The mounting means by which this is accomplished are not shown in FIG. 1 for the sake of simplicity, but are shown in full detail in FIGS. 2 through 5, to which attention is now directed.

In the case of a number of widely used offset presses the frame or other stationary portion of the press includes a substantial horizontal surface running the length of the blanket cylinder. This surface is designated 36 in FIG. 2, and it is exploited as a mounting surface in the practice of the invention. If no such surface exists on a particular press to which the invention is to be applied, a shelf may be added to the press frame to provide one, the geometry of the shelf depending on the geometry of the press frame. Similarly, on many presses, the frame includes a pair of convenient vertical surfaces located above surface 36 at either end of the blanket roll, one of which appears in FIG. 2 where it is designated 37. These, too, are exploited as mounting surfaces in the practice of the invention. Again, if such surfaces are absent from a particular press, they may be added.

The mounting means of the invention includes main mounting plate 38, which slidingly rests on surface 36, and two side mounting plates 39, one attached at either end of plate 38 to press frame surface 37. As can best be seen in FIG. 5, plate 39 has a cut-out 40 in the bottom thereof, while the end of plate 38 has a tongue 41 formed on it. Tongue 41 is narrower than cut-out 40, so that when tongues 41 are fitted into cut-outs 40 at each side of the press, there is room for mounting plate 38 to be slid on surface 36 toward and away from the blanket roll.

In accordance with the invention, control of the position of mounting plate 38 (and of the equipment mounted on it) with respect to the blanket cylinder is provided by adjusting screw 42 which runs in clearance holes 43 and 44 in plate 39 and clearance hole 45 in tongue 41. Adjusting screw 42 is secured to plate 39 by set nuts 46 and 47, and locked against rotation when adjustment is completed by lock collars 48 and 49. Clearance hole 45 in tongue 41 has threaded inserts 50, 51, mounted in either end thereof, and screw 42 is threaded through them. Thus, when adjusting screw 42 is rotated it will push plate 38 toward the blanket cylinder or pull it away from the cylinder, depending upon the direction of rotation of the screw. By turning and then locking the adjusting screws at either end of plate 38, the plate may be brought to the desired position with respect to the blanket roll and held there.

As appears best in FIG. 2, ink fountain 31 is positioned on main mounting plate 38, as are the roll mounting means designated generally as 52.

The structure of roll mounting means 52 may best be understood by a consideration of FIGS. 2-4. In the embodiment shown in those Figures, the roll mounting means comprise a pair of vertically oriented base plates 53, 54 which are positioned parallel to each other on mounting plate 38, one pair being positioned at each end of fountain pan 31. Mounted between the base plates and carried by them are two collars which support the shafts of metering roll 32 and transfer roll 33, these shafts being designated 32*a* and 33*a*, respectively.

Metering roll collar 55 is made up of a pair of bottom yokes 56, 57 which are pivotally mounted on the vertical bases 53, 54 by pin 58, which passes through holes 59, 60 in the bottom yokes and is fixed in holes 61, 62 of vertical base plates 53, 54. The metering roll collar also includes a top yoke 63, one side of which is pivotally attached to the bottom yokes by pin 64, and the other side of which is detachably connected to the bottom yokes by swing bolt 65 and nut 66. Mounted in the yokes of the metering roll collar is a split bushing 67, which engages the housing of anti-friction bearing 67*a* carried on shaft 32*a*. From the foregoing, it can be seen that metering roll 32 can easily be removed from collar 55 by merely loosening nut 66, and swinging top yoke 63 to open the collar. Remounting roll 32 is similarly easily accomplished.

Metering yoke collar 55 and metering roll 32 may be pivoted toward and away from transfer roll 33, the pivoting taking place around 58. The degree of pivoting is controlled by bolt 68, which works in a threaded hole in main mounting plate 38, and which engages wings 69 on bottom yokes 56, 57. In this manner provision is

made for controlling the pressure with which the metering roll and transfer roll contact each other, and this pressure in turn is one means of controlling the rate at which liquid is fed from the fountain pan to the blanket roll

Transfer roll collar **70** is also made up of a pair of bottom yokes **71**, **72**, which are slidingly mounted on vertical base plates **53**, **54** by pins **73**, **74** which pass through holes **75**, **76**, **77**, **78** in the bottom yoke and work in slots **79**, **80**, **81**, **82** in vertical base plates **53**, **54**. The transfer roll collar further includes a top yoke **83**, which is pivoted to the bottom yokes on one side by pin **84**, and detachably connected to them on the other side by swing bolt **85** and nut **86**. Within the yokes is mounted a split bushing **87**, which in turn engages antifriction bearing **87***a* carried on shaft **33***a*. This arrangement facilitates installation and removal of transfer roll 33

An actuating bar **88** is provided for moving transfer roll collar **70**, and transfer roll **33** into and out of contact with the blanket roll. In the embodiment of FIGS. **2-5**, the direction of this movement is substantially vertical, but in other embodiments designed to fit a particular press it may be at an angle or even horizontal. Actuating bar **88** has a slot **89** therein to clear pin **58** and cam slots **90**, **91**, therein positioned to work against pins **73**, **74** of the transfer collar to lift the transfer roll when the actuating bar is moved to the right as FIGS. **3** and **4** are drawn. The end of bar **88** is curved as at **92** to avoid interference with bolt **68**. A solenoid or air-operated piston and cylinder **93** (see FIG. **2**) is provided for power operation of the actuating bar.

From the foregoing discussion of the mounting means of the invention as shown in the embodiment of FIGS. 2-5, it can be seen that the following capabilities are provided: (1) the position of the transfer roll with respect to the blanket roll may be adjusted without altering its position with respect to the metering roll and ink fountain, since these parts move with it on the movable main mounting plate; (2) the contact pressure between the metering roll and the transfer roll can be adjusted by pivoting the metering roll; (3) the transfer roll can be moved into and out of contact with the blanket roll; and (4) both the metering roll and the transfer roll can be easily removed for cleanup and maintenance, or merely to get them out of the way when they are not needed.

Referring again to FIG. **2**, it can there be seen that roll shafts **32***a* and **33***a* have drive gears **94**, **95** mounted thereon adjacent their ends. Alternately, these gears may be mounted inboard of bearings **67***a* and **87***a*, but they have been shown as drawn in FIG. **2** for clarity in presentation. Gears **94**, and **95** are driven by other gears of the drive train (represented diagrammatically at **35** in FIG. **1**) and ultimately by drive motor **34** (FIG. **1**).

An additional means for exercising control over the flow rate of liquid between the fountain pan and the transfer roll is provided by metering bar **96**, which is adjustably mounted on the ink fountain by mounting bracket **97** so that it lies closely adjacent the surface of metering roll **32**. In this way the thickness of the layer of liquid carried on the surface of the metering roll to the nip between it and the transfer roll may be controlled by adjusting the spacing between the bar and the roll

Attention is now directed to FIGS. **6** and **7**, which show an alternate embodiment of the roll mounting means of the invention, which is especially useful on those presses whose structure is such that it is more convenient to move the transfer roll into and out of contact with the blanket cylinder by an actuator which is generally vertically mounted rather than by a horizontal actuator such as that employed in the embodiment of FIGS. **2-5**. Many of the parts are similar or substantially the same as those discussed in connection with that embodiment, and reference is made to the above discussion for a detailed understanding of those parts.

In the embodiment of FIGS. **6** and **7**, the vertical base plates **100** are pivotally mounted between a pair of vertical support plates **101**, which are in turn bolted to main support plate **102**. The pivot point is at bolt **103**, which also serves to anchor metering roll adjusting screw **104** by passing through an eye formed in the end thereof.

The horizontal actuating bar **88** of the FIGS. **2-5** embodiment is omitted, and is replaced by actuating rod **105**, which may be the piston rod of air-operated piston and cylinder unit **106**. Pins **107**, **108**, connect transfer roll collar **109** to vertical base plates **100** so that when actuating rod **105** pivots plates **100** about bolt **103**, the collar **109**, as well as transfer roll **110**, is pivoted toward or away from blanket cylinder **111**, while maintaining its position with respect to the adjusted position of metering roll **112**.

With the foregoing description of the equipment of the invention in hand, its mode of operation, and the mode of operation of an offset press equipped with it, can be described with primary reference to FIG. **1**.

The equipment of the invention **30** is first positioned so that the transfer roll **33** establishes satisfactory contact with the blanket cylinder **11** (when it is actuated into its contact position) by adjusting the portion of the mounting means illustrated in FIG. **5**, and the metering roll pressure against the transfer roll is adjusted to a satisfactory level by pivoting its mounting collar.

As FIG. **1** is drawn, the thickness of the printing stock and the thickness of the layer of ink or coating material on rolls **32** and **33** and blanket cylinder **34** are both greatly exaggerated for clarity of illustration.

FIG. **1**, as drawn, shows the press and the equipment of the invention set up and operating as a paper coater. Plate cylinder **10**, including its dampener **13** and inking system **17**, is spaced out of contact with blanket cylinder **11**, and is inactive in this mode of operation. A fully exposed photosensitive plate is mounted on the blanket cylinder. Coating material (varnish) is placed in fountain **31**. As motor **34** drives metering roll **32** and transfer roll **33**, a layer of coating material is picked up from the fountain and transferred to the plate on the rotating blanket cylinder. As the rotating blanket cylinder engages sheets of paper stock (or a web of stock) presented to it by impression cylinder **12**, the layer of coating material it carries is transferred to the stock, thus coating it.

If the above mentioned photosensitive plate is removed from blanket cylinder **11** and is replaced with a flexographic printing plate and if the coating material in fountain **31** is replaced by flexographic type ink, then FIG. **1**, as drawn, represents the equipment of the invention operating to enable the offset press to print flexographically. Flexographic ink is transferred by rolls **32** and **33** to the image areas of the flexographic plate on blanket cylinder **11**, and thence to the stock.

If the offset press is again needed for conventional offset printing, transfer roll **33** is disengaged from the blanket cylinder, and if desired, it and metering roll **32** may be completely removed from the press. The plate is

removed from the blanket cylinder, and the plate cylinder is returned to engagement with the blanket cylinder, thus restoring the press to conventional offset configuration.

With the press in offset configuration, and with transfer roll 33 engaging the blanket roll, catalyst-set ink printing may be performed, with the catalyst component being placed in fountain 31. Similarly, simultaneous printing and coating, including printing with catalyst set ink may be performed.

I claim:

1. Apparatus for attachment to an offset lithographic press of the kind having a plate cylinder, a blanket cylinder, and an impression cylinder, said apparatus comprising:

an ink fountain

an ink transfer roll;

an ink metering system positioned to transfer ink from said fountain to said transfer roll, said metering system including at least one metering roll;

mounting means for mounting said fountain, transfer roll and metering system on said press adjacent its blanket cylinder, said mounting means including means for adjusting the position of said transfer roll with respect to said blanket cylinder said mounting means comprising;

a main mounting plate slidingly mounted on a substantially horizontal surface of said press adjacent said blanket cylinder;

adjusting screw mounting means attached to said press adjacent each end of said main mounting plate;

an adjusting screw confined against endwise movement in its mounting means but free to rotate therein;

threaded means on said main mounting plate threadedly engaging said adjusting screw, whereby rotation of said adjusting screw slides said main mounting plate toward and away from said blanket cylinder;

said fountain being mounted on said main mounting plate; and

said mounting means further comprising:

(i) vertical base plates mounted on said main mounting plate adjacent each end of said fountain; and

(ii) collars mounted on said vertical plates and engaging said metering roll and said transfer roll to support them above said fountain, the upper portion of said collars being pivotable with respect to the lower portions thereof to thereby provide for rapid removal and installation of said rolls out of and into said collars;

means for adjusting the pressure between said metering roll and said transfer roll;

means for moving said transfer roll into and out of contact with said blanket cylinder including means mounting said collars engaging said transfer roll on said vertical base plates for movement with respect to said vertical base plates toward and away from said blanket cylinder; and

a variable speed motor for said metering roll and said transfer roll.

2. Apparatus in accordance with claim 1 in which said adjusting screw mounting means comprise a side mounting plate mounted on said press adjacent an end of said main mounting plate, said side mounting plate having a cut-out in the bottom thereof, and in which

said main mounting plate has a tongue at an end thereof narrower than said cut-out and projecting thereinto, and in which

said adjusting screw passes through said side mounting plate and said tongue.

3. Apparatus in accordance with claim 1 and further comprising mounting means for each of said collars engaging said transfer roll each of said collar mounting means comprising:

a guide slot on one of said vertical base plates;

an actuating bar positioned parallel to said one vertical base plate;

a cam slot in said actuating bar; and

a pin in each of said collars passing through said guide slot and said cam slot, to thereby provide for said movement of said collars toward and away from said blanket cylinder upon reciprocal movement of said actuating bar along said vertical base plate.

4. Apparatus in accordance with claim 1 in which said mounting means for said collars engaging said transfer roll comprises:

pivot means on said vertical base plates mounting both said transfer roll engaging collars and the collars for said metering roll for pivoting movement with respect to said blanket cylinder; and

an actuating rod for effecting said pivotal movement.

* * * * *

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United States Patent [19]

Rebel

[11] **4,372,244**

[45] **Feb. 8, 1983**

[54] **VARNISHING UNITS ON PRINTING PRESSES**

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[21] Appl. No.: **328,531**

[22] Filed: **Dec. 8, 1981**

[30] **Foreign Application Priority Data**

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[51] **Int. Cl.**^{3} **B05C 1/16**

[52] **U.S. Cl.** **118/46**; 118/222; 118/262

[58] **Field of Search** 118/204, 221, 222, 262, 118/46

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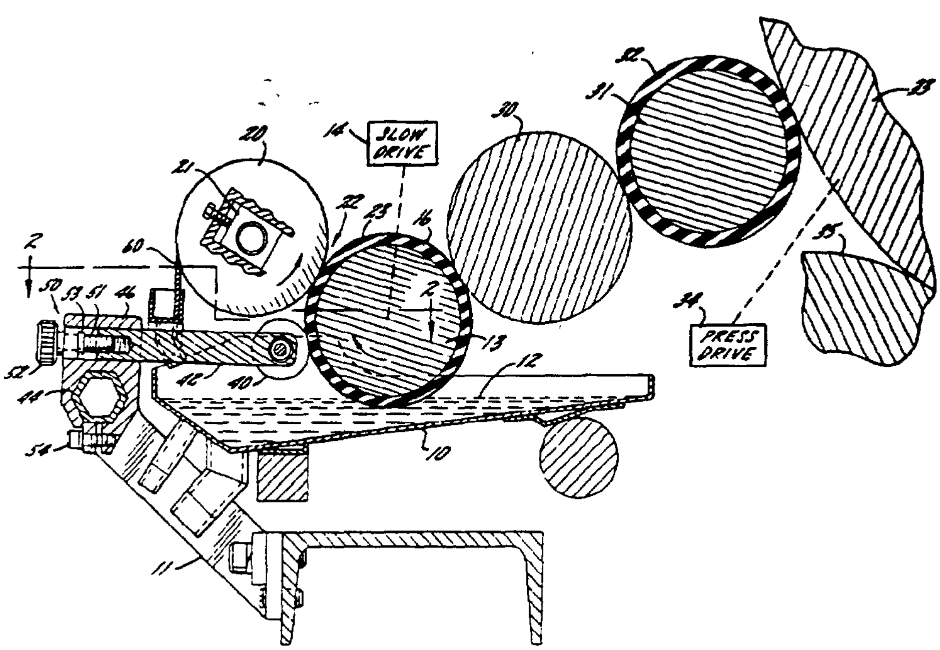
[57] **ABSTRACT**

A varnishing unit for applying varnish in a strip of selected width on a sheet carried on the impression cylinder of a printing press distinguished by use of a plurality of adjustable varnish blocking rollers arranged adjacent a fountain roller between a varnish trough and a metering nip formed between a metering roller and the fountain roller. The blocking rollers are hard surfaced and of relatively small diameter, and are secured to the frame by arms located at the respective ends of each roller. Each blocking roller is individually adjustable between (a) a position in which it forcibly indents the surface of the fountain roller so as to substantially cut off the flow of varnish to the metering nip, in the region of width controlled by the blocking roller and (b) a position withdrawn from the surface of the fountain roller to permit passage of a strip of varnish in the controlled region to the metering nip and thence via intermediate rollers to the varnishing cylinder. The arms can be differentially adjusted so that the flow of varnish may be blocked off at one end of the roller but not at the other to achieve a varnish strip of a width which is less than the length of the blocking roller. Furthermore, the arms on which the blocking rollers are mounted are slidable on a cross beam which extends parallel to the fountain roller to permit adjustment of the position of the region controlled by the blocking roller.

4 Claims, 5 Drawing Figures



W019194

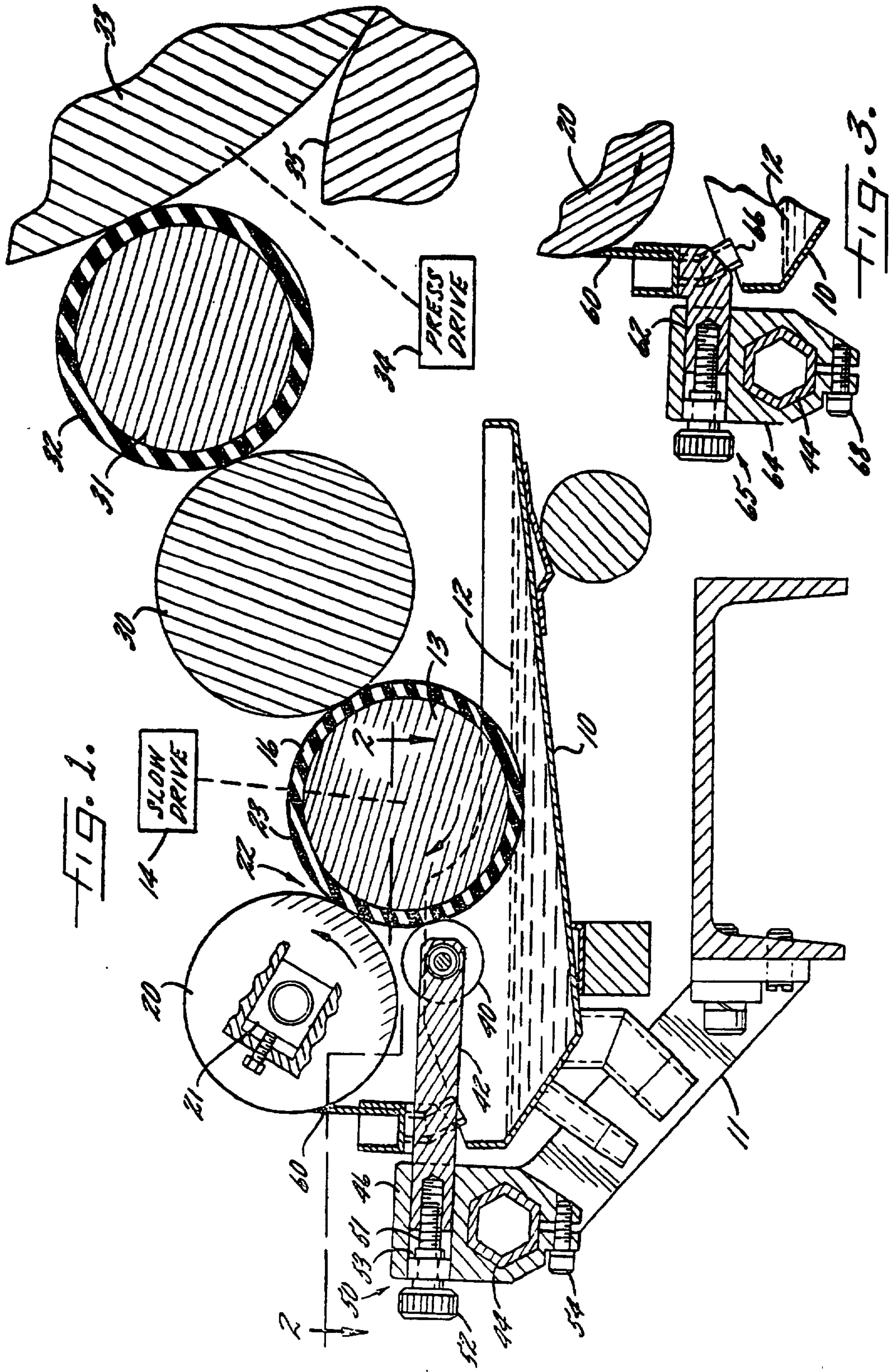


FIG. 1.

FIG. 3.

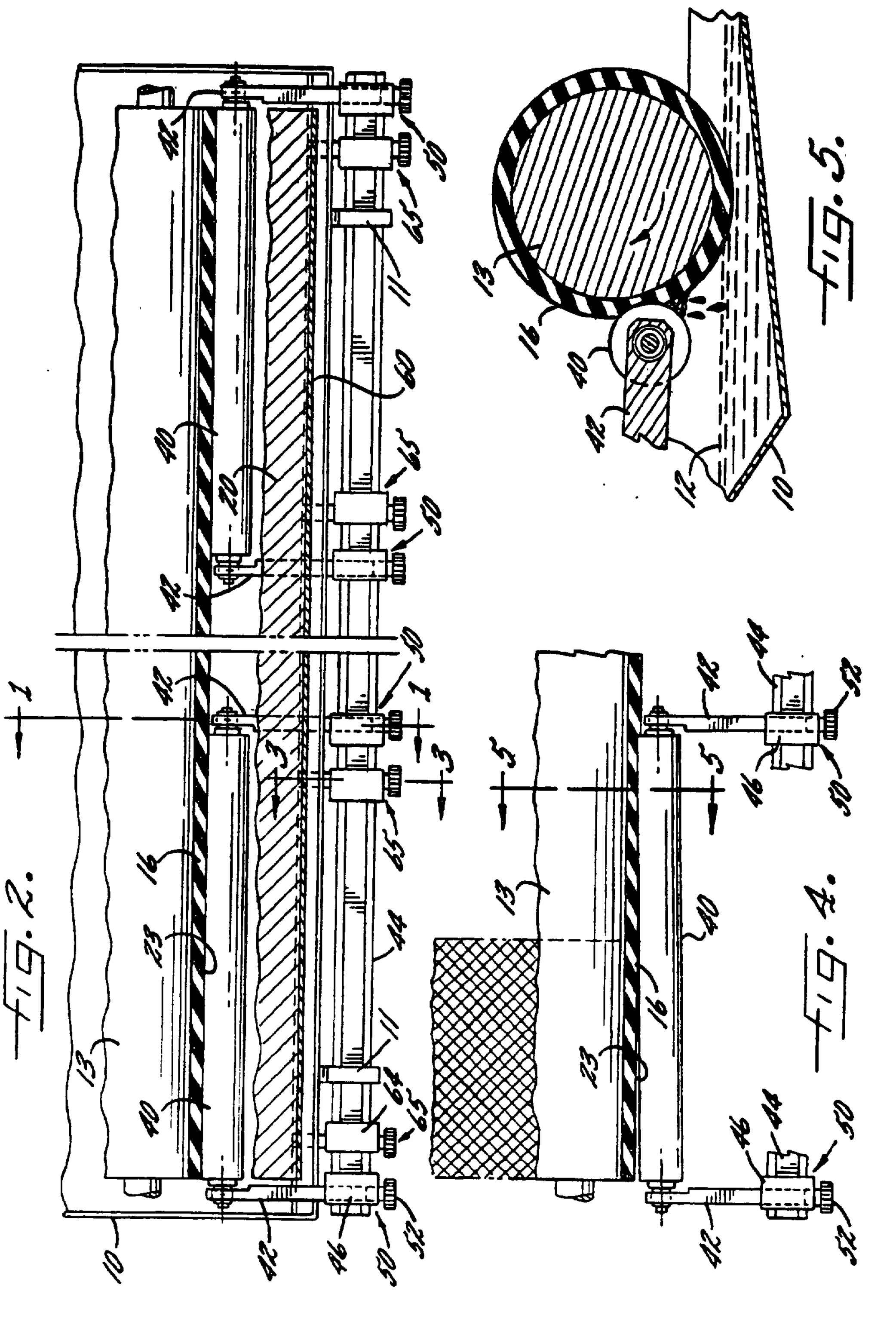


Fig. 2.

Fig. 4.

Fig. 5.

VARNISHING UNITS ON PRINTING PRESSES

When printing pages requiring a glossy finish, as is common in many of today's magazines and catalogues, a varnish must be applied to the printed sheet to provide the gloss. As is well known in the art, varnish is transferred through a series of rollers to a varnishing cylinder, which rollingly engages an impression cylinder to transfer the varnish to the printed matter carried by the impression cylinder. However, a problem has arisen when sheets of various size are sought to be varnished. There has not been a satisfactory way to use a single varnishing unit to apply varnish to sheets of different width, or to apply varnish in a strip of a desired width and location on a sheet.

It is, accordingly, an object of the present invention to provide a varnishing unit for a printing press which can be used to apply varnish to printed sheets of various width or in a strip of desired width and location. It is a related object to provide a varnishing unit in which the working areas of the rollers which transfer the varnish to the varnishing cylinder can be quickly and easily adjusted. A further object lies in the provision of an adjustable width varnishing unit which is both economical and simple to make and operate.

More specifically, it is an object of the present invention to provide blocking rollers which are adjustable both endwise and in skewed engagement with a fountain roller to selectively control the working areas of the fountain roller, its metering roller, and other rollers which carry the varnish eventually transferred to the varnishing cylinder for application to the printed matter.

Other objects and advantages of the invention will become apparent upon reading the attached detailed description and upon reference to the drawings in which:

FIG. 1 is a vertical cross-sectional view taken generally along line 1—1 in FIG. 2 showing a varnishing unit embodying the present invention;

FIG. 2 is a plan view in partial section taken generally along line 1—1 in FIG. 1;

FIG. 3 is a fragmentary section taken along line 3—3 of FIG. 2 showing a scraper blade forming part of the present invention;

FIG. 4 is a partial plan view, similar to the view in FIG. 2, showing a blocking roller adjusted to permit varnish to be transmitted only over a narrow width on the fountain roller; and

FIG. 5 is a fragmentary section taken along line 5—5 in FIG. 4 showing the blocking effect of the blocking roller.

While the invention will be described in connection with a preferred embodiment, it will be understood that there is no intention to limit the invention to the construction shown but, on the contrary, but it is intended to cover the various alternative and equivalent constructions included within the spirit and scope of the appended claims.

Turning now to FIG. 1, there is shown a typical varnishing unit having a trough 10, supported by a frame 11, for holding the varnish supply 12, and a fountain roller 13 which is partially immersed in the varnish supply so that, upon rotation of the fountain roller 13 by a slowly rotating driving means 14, the entire submerged length of the fountain roller 13 will be coated with varnish The fountain roller 13 is provided with a

resilient surface layer 16 and is rollingly engaged by a hard-surfaced metering roller 20 to form a metering nip 22. The metering roller 20 includes means 21 for adjusting the degree of indentation of the metering roller upon the fountain roller. The degree of this indentation determines the thickness of the film of varnish 23 which will cling to the fountain roller 13 on the downstream side of the metering nip 22.

Downstream of the metering nip 22, the fountain roller 13 is engaged by a hard-surfaced distributor roller 30. The distributor roller 30 accepts the film of varnish from the fountain roller 13 and in turn transfers the film to a form roller 31 having a resilient surface layer 32, which is mounted for rolling engagement with the distributor roller 30. The form roller 31 in turn transfers the film of varnish to a varnishing cylinder 33, which is driven by a press drive 34. The varnishing cylinder 33 is arranged for engagement with a sheet of printed matter (not shown) carried on a conventional impression cylinder 35, shown symbolically, so that the film of varnish carried by the varnishing cylinder 33 is applied to the sheet. Slippage occurs between rollers 13 and 30.

In carrying out the present invention, a plurality of varnish blocking rollers 40 are arranged adjacent the fountain roller 13 between the varnish trough 10 and the metering nip 22 when viewed in the direction of rotation of the fountain roller. The blocking rollers 40 are hard surfaced and of relatively small diameter in comparison with the fountain roller 13. The blocking rollers 40 are mounted to the frame 11 and have adjusting means for individual adjustment of each blocking roller between (a) a position in which the blocking roller forcibly indents the resilient surface of the fountain roller to substantially cut off the flow of varnish to the metering nip 22 in the indented region of the fountain roller, and (b) a position in which the blocking roller 40 is withdrawn from engagement with the fountain roller 13 to permit a passage of a film of varnish on the section of the fountain roller which is potentially engageable with the blocking roller 40. This film of varnish travels through the metering nip 22 and is eventually transferred to the varnishing cylinder 33 for application to the sheet on the impression cylinder 35. Thus, each blocking roller 40 defines a controlled region of width on the fountain roller for the transmission of varnish.

More specifically, each blocking roller 40 is journaled at its respective ends by a pair of arms 42. These arms 42 are secured to a cross beam 44 through brackets 46, the cross beam 44 being secured to the frame 11 and extending parallel to the fountain roller 13. Each bracket 46 mounts an arm adjusting mechanism 50 which includes a threaded screw 51 having a knob 52 and a collar 53. The threaded screw 51 engages the internal threads of a bore in each arm 42, while the collar holds the screw captive in the bracket. By rotating the knob 52, and thus either screwing the thread 51 into or out of the threaded bore in the arm 42, the blocking roller can be either moved into engagement with, or away from, the fountain roller 13. As shown in FIG. 5, the arms may be adjusted so that the blocking roller 40 forcibly indents the surface of the fountain roller 13 so that the flow of varnish is substantially completely blocked off, with the intercepted varnish simply dripping back into the trough.

Because no varnish will be carried on the resilient surface 16 of the fountain roller 13 which is indentedly engaged by a blocking roller 40, the region or zone of the fountain roller 13 which does not transmit a film of

varnish can be varied by selective engagement of a blocking roller. Thus, the width of the film of varnish, and the active regions of the rollers over which it is transmitted, can be adjusted so that a film of varnish is applied to only a selected portion of the varnishing cylinder 33.

Also in keeping with the present invention, each bracket 46 is clamped to the cross beam 44 with a screw 54. With these clamping screws 54 loosened, the brackets 46 and their corresponding arms 42 can be shifted along the cross beam 44 to achieve endwise adjustment of each blocking roller, thus permitting endwise adjustment of the position of the region controlled by the blocking roller for control of the flow of varnish to the surface of the varnishing cylinder. The present device thus permits a strip of varnish of selected widtih to be carried at a selected position on the fountain roller for eventual transmission to the impression cylinder of a printing press.

In practicing the invention, a scraper blade 60 engages the metering roller 20 on the downstream side of the nip 22 to scrape off varnish which clings to the metering roller 20, returning it to the trough 10. The scraper blade 60 allows the metering roller 20 to act on the fountain roller 13 without affecting the varnish-free areas of the fountain roller, as any residual varnish has been substantially removed from the metering roller. As best seen in FIG. 3, the resilient scraper blade 60 is held by arms 62, which are in turn held in adjustable brackets 64 mounted on the cross beam 44. The arms 62 are mounted for movement within the bracket 64 in an adjusting device 65 similar to that disclosed at 50 with respect to the arms which hold the blocking rollers. The adjustability of the radial position of the scraper blade permits the blade to be moved in concert with the metering roller 20, as the metering roller is moved to vary the degree of its indentation upon the fountain roller, which varies the quantity of varnish carried by the fountain roller.

The scraper blade 60 transmits the varnish scraped off the metering roller 20 back into the varnish trough 10 through a return channel 66, which is held by the arms 62. Similarly to the brackets 46 disclosed in conjunction with the blocking rollers, brackets 64 are also slidable along the length of the cross beam 44. Each bracket 64 has a clamping screw 68 which, when a desired position of the slidable bracket 64 is reached, can be tightened to securely hold the scraper blade in its desired position. A single scraper blade which extends over the full length of the metering roller is preferred, although multiple scraper blades may be employed if desired, one corresponding to each blocking roller. The removal of the excess varnish on the metering roller by the scraper blade insures that no varnish can be recirculated on the on the metering roller back to the metering nip.

In keeping with the invention, each arm adjusting mechanism 50 can be independently manipulated so that one end of its corresponding blocking roller 40 forcibly indents the surface of the fountain roller 13 to block off, at that end, the flow of varnish to the metering nip 22, while the other end of the blocking roller is withdrawn from the fountain roller 13 by its arm adjusting mechanism 50. This is best shown in FIG. 4 and allows for a strip of varnish of a width less than the length of the blocking roller 40 (indicated by the cross-hatching in FIG. 4) to be transferred by the fountain roller 13 to, eventually, the varnishing cylinder 33 for application to a sheet on the impression cylinder 35. Thus, by selectively adjusting the portion of a blocking roller 40 which engages the fountain roller 13, the varnish strip which is carried by the fountain roller can be varied to any length less than the length of the blocking roller.

It will be apparent that the objects of the invention have been amply fulfilled. The blocking rollers 40 mounted on slidable adjustable arms 42 and brackets 46 permit a strip of varnish of a selected width to be carried by a selected region of the fountain roller for application to a sheet of printed material carried by the impression cylinder.

I claim:

1. A varnishing unit for applying varnish in a strip of selected width on a sheet carried on the impression cylinder of a printing press comprising, in combination, a frame, a varnishing cylinder arranged for engagement with the sheet on the impression cylinder, a varnish trough, a resiliently surfaced fountain roller, driving means for slowly rotating the fountain roller in the varnish in the trough, a hard surfaced metering roller in rolling engagement with the fountain roller to form a metering nip, means for adjusting the degree of indentation of the metering roller upon the fountain roller thereby to determine the thickness of the film of varnish which clings to the fountain roller on the downstream side of the nip, a scraper blade on the metering roller on the downstream side of the nip for scraping off the varnish which clings to the metering roller for return thereof to the trough, a hard surfaced distributor roller in engagement with the fountain roller downstream of the nip for accepting the film of varnish, a resilient form roller in rolling engagement with the distributor roller for transferring the film to the varnishing cylinder, and a plurality of varnish blocking rollers arranged adjacent the fountain roller between the trough and the metering nip, the blocking rollers being hard-surfaced and of relatively small diameter, means including arms at the respective ends of each roller and secured to the frame for supporting the blocking rollers end to end so that each defines a region of width on the fountain roller for control of varnish flow, the arms having adjusting means for individual adjustment of each blocking roller between (a) a forcibly indented position on the surface of the fountain roller sufficient to substantially cut off the flow of varnish to the metering nip in the region of width controlled by the blocking roller and (b) a withdrawn position permitting passage of a strip of varnish in the controlled region to the metering nip and thence to the varnishing cylinder, the adjusting means at each end of a blocking roller being differentially adjustable so that flow of varnish may be blocked off at one end of the blocking roller but not at the other thereby to achieve a varnish strip of a width which is less than the length of the blocking roller.

2. The combination as claimed in claim 1 in which the frame of the press has a cross beam extending parallel to the fountain roller, the supporting arms being slidably mounted on the cross beam to achieve endwise adjustment of each blocking roller thereby to adjust the position of the region controlled by the blocking roller for control of flow of varnish to the surface of the varnishing cylinder.

3. The combination as claimed in claim 1 in which the scraper blade extends over the full length of the metering roller.

4. The combination as claimed in claim 2 in which adjustable brackets are provided for mounting the scraper blade, the adjustable brackets being mounted upon the cross beam and having provision for adjustment with respect thereto.

* * * * *

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United States Patent [19]

Fujimoto et al.

[11] **4,379,039**

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[54] **ULTRAVIOLET CURABLE RESIN COMPOSITION**

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[58] **Field of Search** 204/159.15, 159.19; 525/35, 44

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[57] **ABSTRACT**

An ultraviolet curable resin composition comprising

(I) a saturated copolyester having a molecular weight of 2,000 to 15,000 which is soluble in a polymerizable compound (II), 20% by mole or more of saturated polycarboxylic acid components of the saturated copolyester being an aromatic dicarboxylic acid,

(II) a polymerizable compound, at least a part of which is a compound having two or more polymerizable double bonds in the molecule thereof, and

(III) a photosensitizer.

The ultraviolet curable resin composition has excellent flexibility, adhesion and processability and is useful as an ink composition for screen printing and a transfer paper for decorating potteries and further as an adhesive for the preparation of laminated products.

22 Claims, No Drawings

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ULTRAVIOLET CURABLE RESIN COMPOSITION

The present invention relates to an ultraviolet curable resin composition. More particularly, it relates to an ultraviolet curable composition composed of a saturated copolyester (I) having a molecular weight of 2,000 to 15,000 which is soluble in a polymerizable compound, a polymerizable compound (II) and a photosensitizer (III), said composition having excellent flexibility, adhesion and processability.

Recently, with social demands such as conservation of resources, inhibition of environmental pollution, safety, and the development of non-solvent type resins, the development ultraviolet curable resins has progressed rapidly. Hitherto various resins have been proposed suitable as a binder for ultraviolet curable inks, paints or coatings such as epoxyacrylates, urethane-modified acrylates, oligo ester acrylates, or the like (cf. Japanese Patent Publication Nos. 37902/1978, 15691/1979 and 15473/1979), but these resins have merely been used in a part of the paper or wooden product fields.

Although these prior ultraviolet curable inks, paints or coating agents have merits such as non-pollution, rapid curability and conservation or resources, use of them has not necessarily sufficiently progressed, because they are remarkably inferior to the conventional products in adhesion, flexibility and processability. Accordingly, it is necessary to improve the adhesion properties to various metals, plastics, films, coated metal plates, and further flexibility and processability thereof in order to expand the utilities of the ultraviolet curable resins.

However, there have never been found any ultraviolet curable resins having excellent adhesion, flexibility and processability, and hence, the improvement of adhesion is usually done by subjecting the base materials to be coated to specific and complicated pretreatment (cf. Japanese Patent Laid Open Application No. 150504/1975). Such a pretreatment of the base materials results in complication of process steps and also in increased cost of products. There is also proposed an ultraviolet curable polyester binder and coating composition comprising a specific polyester, an ethylenically unsaturated photopolymerizable compound and a photopolymerization initiator (cf. U.S. Pat. No. 4,110,187), but the materials used therein show inferior compatibility for each other and the composition is occasionally obtained in the form of a turbid solution or gel, shows low adhesion, and gives a cured coating layer having relatively poor strength.

Thus, there has never been found any ultraviolet curable resin having excellent adhesion, flexibility and processability, and the development of a resin having such excellent properties is desired.

As a result by intensive study of the present inventors, there has been found an ultraviolet curable resin composition, having excellent adhesion to various metals, plastics, films, coated metal plates and also flexibility and processability without any complicated pretreatment, by using a specific saturated copolyester which is soluble in a polymerizable compound.

An object of the present invention is to provide an ultraviolet curable resin composition having excellent adhesion, flexibility and processability. Another object of the invention is to provide an ultraviolet curable coating composition. A further object of the invention is to provide an ultraviolet curable ink composition suitable for screen printing. A further object of the invention is to provide a laminated product wherein the ultraviolet curable composition as set forth above is used as a binder. A still further object of the invention is to provide a transfer paper for decorating pottery. These and other objects and advantages of the present invention will be apparent to skilled persons in the art from the following description.

The ultraviolet curable resin composition of the present invention comprises

(I) a saturated copolyester having a molecular weight of 2,000 to 15,000 which is soluble in a polymerizable compound (II), 20% by mole or more of saturated polycarboxylic acid component of the saturated copolyester being an aromatic dicarboxylic acid,

(II) a polymerizable compound, at least a part of which is a compound having two or more polymerizable double bonds in the molecule, and

(III) a photosensitizer.

The saturated copolymester (I) having a molecular weight of 2,000 to 15,000 which is soluble in a polymerizable compound (II) includes a polyester derived from a saturated polycarboxylic acid or its derivative and a polyvalent alcohol. Suitable examples of the saturated polycarboxylic acid are aromatic dicarboxylic acids, such as terephthalic acid, isophthalic acid, orthophthalic acid, 2,6-naphthalenedicarboxylic acid; aliphatic dicarboxylic acid, such as succinic acid, adipic acid, azelaic acid, sebacic acid, dodecanedionic acid; alicyclic dicarboxylic acids, such as 1,4-cyclohexanedicarboxylic acid, tetrehydrophthalic acid, hexahydrophthalic acid, chlorendic acid; or the like, which may be used alone or in combination of two or more kinds thereof. Suitable examples of the polyvalent alcohol are alkylene glycols, such as ethylene glycol, propylene glycol, 1,4-butanediol, 1,6-hexanediol, 1,5-pentanediol, neopentyl glycol; polyalkylene glycols, such as diethylene glycol, triethylene glycol, tetra- or more polyethylene glycols, dipropylene glycol, tri- or more polypropylene glycol; halogenated alkylene glycols such as dibromoneopentyl glycol; bisphenol A ethylene oxide and/or propylene oxide adduct; hydrogenated bisphenol A ethylene oxide and/or propylene oxide adduct; 1,4-cyclohexanedimethanol, or the like, which may be used alone or in combination of two or more kinds thereof. The saturated polycarboxylic acid components may also contain tri- or more polycarboxylic acids such as trimellitic acid, pyromellitic acid, and the polyvalent alcohol components may also contain tri- or more polyvalent alcohols such as trimethylolpropane, trimethylolethane, pentaerythritol A small amount of a monocarboxylic acid or a monovalent alcohol may optionally be copolymerized.

The saturated copolyester (I) can be produced by any conventional process, such as an ester exchange process, or a direct esterification process, wherein a conventional catalyst such as tetra-n-butyl titanate or stannous oxalate may optionally be used.

The saturated copolyester (I) comprises as the polycarboxylic acid component 20% by mole or more of an aromatic dicarboxylic acid, particularly terephthalic acid and/or isophthalic acid. Particularly suitable polycarboxylic acid components of the saturated copolyester (I) comprise 19 to 98% by mole of terephthalic acid, 1 to 80% by mole of isophthalic acid and 80 to 1% by mole of an aliphatic dicaroxylic acid having 3 to 30 carbon atoms. Another suitable polycarboxylic acid

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components comprise 20 to 70% by mole of terephthalic acid and 80 to 30% by mole of isophthalic acid, or comprise 20 to 70% by mole of terephthalic acid and 80 to 30% by mole of an aliphatic dicarboxylic acid having 3 to 30 carbon atoms. Suitable polyol components of the saturated copolyester (I) comprise 10 to 80% by mole of ethylene glycol and 90 to 20% by mole of an alkylene glycol selected from propylene glycol, butanediol, neopentyl glycol and hexanediol, or comprise 10 to 90% by mole of butanediol and 90 to 10% by mole of an alkylene glycol selected from propylene glycol, neopentyl glycol and hexanediol.

The saturated copolyester (I) may optionally be copolymerized with 0.5 to 20% by mole of an aromatic dicarboxylic acid having a metal sulfonate group, i.e. metal salts of sulfo-aromatic dicarboxylic acids, such as sulfoterephthalic acid, 5-sulfoisophthalic acid, 4-sulfophthalic acid, 4-sulfonaphthalene-2,7-dicarboxylic acid, 5-(4-sulfophenoxy)isophthalic acid, or the like. The metal salts include salts of the metals such as lithium, sodium, potassium, magnesium, calcium, copper, iron or the like. Such saturated copolyesters (I) are particularly suitable for the preparation of ultraviolet curable resin compositions having excellent pigment-dispersibility and adhesion.

The saturated copolyester (I) used in the present invention should be soluble in the polymerizable compound (II). That is, the saturated copolyester should be soluble in the polymerizable compound (II), particularly an acrylic ester or methacrylic ester, in an amount of at least 10% by weight, preferably 20% by weight or more, and can give a homogeneous, transparent solution. Saturated copolyesters having a high crystallizability, such as polyethylene terephthalate, polybutylene terephthalate have lower solubility, and hence, they are made soluble by copolymerizing with a polycarboxylic acid such as isophthalic acid or adipic acid and a glycol such as propylene glycol or 1,6-hexanediol. In view of the solubility, the suitable combinations of the acid components of the saturated copolyester (I) are a combination of two components of terephthalic acid and isophthalic acid, or of terephthalic acid and adipic acid; and three components of terephthalic acid, isophthalic acid and adipic acid, or of terephthalic acid, isophthalic acid and sebacic acid. Besides, suitable combinations of the glycol components are a combination of two components of ethylene glycol and propylene glycol, of ethylene glycol and hexanediol, or of ethylene glycol and neopentyl glycol, but they are not limited thereto.

The solubility of the saturated copolyester (I) is also affected by the acid value or molecular weight thereof, and hence, the saturated copolyester (I) should have a molecular weight of 2,000 to 15,000 and an acid value of less than 50. When the saturated copolyester (I) contains nitrogen atom, they show unfavorably low weatherability and low storage stability.

The polymerizable compound (II) is a photopolymerizable compound having at least one polymerizable double bond in the molecule and at least a part (i.e. 1 to 100% by mole) thereof having two or more polymerizable double bonds in the molecule. Preferably, the polymerizable compound (II) comprises 10 to 95% by weight of a compound having one polymerizable double bond in the molecule and 90 to 5% by weight of a compound having two or more polymerizable double bonds in the molecule.

Suitable examples of the photopolymerizable compound having one polymerizable double bond in the molecule are (i) styrene compounds, such as styrene, α-methylstyrene, chlorostyrene; (ii) alkyl acrylates or methacrylates (hereinafter, expressed as "(meth)acrylate"), such as methyl (meth)acrylate, ethyl (meth)acrylate, n- and i-propyl (meth)acrylate, n-, sec- and tert-butyl (meth)acrylate, 2-ethylhexyl (meth)acrylate, lauryl (meth)acrylate, stearyl (meth)acrylate, tetrahydrofurfuryl (meth)acrylate, cyclohexyl (meth)acrylate; alkoxyalkyl (meth)acrylate, such as methoxyethyl (meth)acrylate, ethoxyethyl (meth)acrylate, butoxyethyl (meth)acrylate; aryloxyalkyl (meth)acrylates such as phenoxyethyl (meth)acrylate; hydroxyalkyl (meth)acrylates such as hydroxyethyl acrylate; halogen-substituted alkyl (meth)acrylates; polyalkylene glycol mono(meth)acrylates such as polyethylene glycol mono(meth)acrylate, polypropylene glycol mono(meth)acrylate; substituted alkyl mono(meth)acrylates such as alkoxypolyoxyalkylene mono(meth)acrylate; (iii) mono(meth)acrylate of bisphenol A alkylene oxide adducts such as bisphenol A ethylene oxide and/or propylene oxide adduct, mono(meth)acrylates of hydrogenated bisphenol A alkylene oxide adducts such as hydrogenated bisphenol A ethylene oxide and/or propylene oxide adduct; (iv) urethane-modified mono(meth)acrylates having one (meth)acryloyloxy group in the molecule which is prepared by reacting a diisocyanate compound and a compound containing a terminal isocyanate group, followed by reacting the resulting compound containing a terminal isocyanate group with an alcoholic hydroxy group-containing (meth)acrylate; (v) a epoxy mono(meth)acrylate which is prepared by reacting a compound having one or more epoxy group in the molecule with acrylic or methacrylic acid; (vi) an oligo ester mono(meth)acrylate which is prepared by reacting a carboxylic acid selected from acrylic acid, methacrylic acid and a polycarboxylic acid with an alcohol selected from two or more polyvalent alcohols. Among them, phenoxyethyl methacrylate and tetrahydrofurfuryl acrylate are preferable.

Suitable examples of the photopolymerizable compounds having two polymerizable double bonds in the molecule are (i) alkylene glycol di(meth)acrylates, such as ethylene glycol di(meth)acrylate, propylene glycol di(meth)acrylate, 1,4-butanediol di(meth)acrylate, neopentyl glycol di(meth)acrylate, 1,6-hexanediol di(meth)acrylate; polyoxyalkylene glycol di(meth)acrylates, such as diethylene glycol di(meth)acrylate, triethylene glycol di(meth)acrylate, tri- or more polyethylene glycol di(meth)acrylates, polypropylene glycol di(meth)acrylate; substituted alkylene glycol di(meth)acrylates, such as halogen-substituted alkylene glycol di(meth)acrylates, hydroxy-substituted alkylene glycol di(meth)acrylates; (ii) di(meth)acrylate of bisphenol A alkylene oxide adducts such as bisphenol A ethylene oxide and/or propylene oxide adduct, di(meth)acrylate of hydrogenated bisphenol A alkylene oxide adduct such as hydrogenated bisphenol A ethylene oxide and/or propylene oxide adduct; (iii) urethane-modified di(meth)acrylates having two (meth)acryloyloxy groups in the molecule which is prepared by reacting a diisocyanate compound with a compound containing two or more alcoholic hydroxy groups, followed by reacting the resulting terminal isocyanate group-containing compound with an alcoholic hydroxy group-containing (meth)acrylate; (iv) an epoxy di(meth)acrylate which is prepared by reacting a compound containing two epoxy groups in the molecule with acrylic or methacrylic acid; (v) an oligo ester di(meth)acrylate which is prepared by

reacting a carboxylic acid selected from acrylic acid, methacrylic acid and a polycarboxylic acid with an alcohol selected from two or more polyvalent alcohol.

Suitable examples of the photopolymerizable compounds having three or more polymerizable double bonds in the molecule are (i) poly(meth)acrylate of tri- or more polyvalent aliphatic alcohols, such as trimethylolpropane tri(meth)acrylate, trimethylolethane tri(meth)acrylate, pentaerythritol tetra(meth)acrylate; poly(meth)acrylate of tri- or more polyvalent halogen-substituted alcohol or tri- or more polyvalent hydroxy-substituted aliphatic alcohol; (ii) a urethane-modified poly(meth)acrylate which is prepared by reacting a diisocyanate compound with a compound containing two or more alcoholic hydroxy groups, followed by reacting the resulting terminal isocyanate group-containing compound with an alcoholic hydroxy group-containing (meth)acrylate.

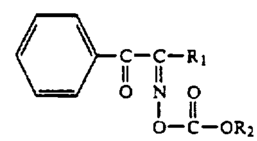
These polymerizable compounds (II) may be used alone or in combination of two or more kinds thereof. However, at least a part of the polymerizable compounds (II) should be a compound having two or more polymerizable double bonds in the molecule. That is, the polymerizable compound (II) to be incorporated into the present ultraviolet curable resin composition comprises 1 to 100% by weight, preferably 5 to 90% by weight, [based on the whole weight of the polymerizable compounds (II)] of a compound having two or more polymerizable double bonds in the molecule. When the polymerizable compound (II) comprises a compound having one polymerizable double bond in the molecule and a compound having two, three or four polymerizable double bonds in the molecule, the compound having two or more polymerizable double bonds is preferably used in an amount of 5 to 70% by weight based on the whole polymerizable compounds. Besides, when the polymerizable compound (II) comprises a compound having two polymerizable double bonds in the molecule and a compound having three or four polymerizable double bonds in the molecule, the compound having two polymerizable double bonds is preferably used in an amount of 85 to 95% by weight based on the whole polymerizable compounds. When the polymerizable compound (II) consists of only a compound having one polymerizable double bonds in the molecule, it can not be used in the present invention, because the composition can not be cured.

Particularly preferred polymerizable compound (II) comprises (a) 10 to 70% by weight of a mono(meth)acrylate, (b) 5 to 50% by weight of one or more poly(meth)acrylates selected from two or more poly(meth)acrylates having a molecular weight smaller than 500, dipentaerythritol penta(meth)acrylate and dipentaerythritol hexa(meth)acrylate, and (c) 20 to 70% by weight of di(meth)acrylate having a molecular weight of larger than 500, which is particularly suitable for the preparation of ultraviolet curable composition having excellent solvent resistance and excellent adhesion.

The saturated copolyester (I) and the polymerizable compound (II) are incorporated in the weight ratio of a saturated copolyester (I): a polymerizable compound (II)=10:90 to 80:20, preferably 30:70 to 70:30 When the copolyester (I) is incorporated in an amount of less than 10% by weight, there can not be obtained the desired ultraviolet curable resin composition having excellent adhesion and flexibility, and on the other hand, when the copolyester (I) is used in an amount of more than 80% by weight, the composition is too viscous and is not practically useful.

The photosensitizer (III) used in the present invention includes any compounds which can promote the photopolymerization reaction of the above polymerizable compounds (II), for example, benzoins such as benzoin methyl ether, benzoin ethyl ether, benzoin i-propyl ether, benzoin, α-methylbenzoin; anthraquinones such as 9,10-anthraquinone, 1-chloroanthraquinone, 2-chloroanthraquinone; benzophenones such as benzophenone, p-chlorobenzophenone, p-dimethylaminobenzophenone; sulfur-containing compounds such as diphenyl disulfide, tetramethylthiuram disulfide; pigments such as methylene blue, eosine, fluoresceine; or the like, which may be used alone or in combination of two or more kinds thereof.

Other suitable photosensitizers are (a) one or more compounds selected from xanthone, thioxanthone and a derivative thereof and (b) a compound of the formula:



(I)

wherein R_1 and R_2 are each a hydrocarbon group having 1 to 10 carbon atoms. These compounds (a) and (b) may be used each alone but are preferably used in combination thereof in the weight ratio of 4/1 to 1/4. When such a specific combination of photosensitizer is used, there can be obtained an ultraviolet curable resin composition having excellent curability as well as excellent adhesion, flexibility and processability.

Suitable examples of the xanthone, thioxanthone or derivatives thereof (a) are xanthone, and its alkyl-, nitro- and/or halogen-substituted derivatives such as 2-methylxanthone, 2-ethylxanthone, 3-methylxanthone, 3-ethylxanthone, 3-methoxyxanthone, 3-ethoxyxanthone, 2-methyl-7-nitroxanthone, 2-nitroxanthone, 2-chloroxanthone, 2,7-dichloroxanthone, 2,7-dinitroxanthone; thioxanthone and its alkyl-, nitro- and/or halogen-substituted derivatives such as 2-methylthioxanthone, 2-isopropylthioxanthone, 2-chlorothioxanthone, 2-nitrothioxanthone, 3-nitrothioxanthone, 2-methoxythioxanthone, 2-methyl-7-nitrothioxanthone, 2,7-dimethylthioxanthone; or the like.

In the above compound of the formula (I), the groups R_1 and R_2 are a hydrocarbon group having 1 to 10 carbon atoms, particularly, an alkyl having 1 to 10 carbon atoms (e.g. metyl, ethyl, propyl. butyl, etc.), an aryl having 6 to 10 carbon atoms (e.g. phenyl, xylyl, tolyl, etc.) and an aralkyl having 7 to 10 carbon atoms (e.g. phenylmethyl, phenylethyl, etc.). Suitable examples of the compound (I) are 1-phenyl-1,2-propanedione-2-(O-ethoxycarbonyl)oxime, 1-phenyl-1,2-propanedione-2-(O-n-propoxycarbonyl)oxime, 1-phenyl-1,2-butanedione-2-(O-ethoxycarbonyl)oxime, 1-phenyl-1,2-butanedione-2-(O-n-propoxycarbonyl)oxime, 1,2-diphenyl-1,2-ethanedione-1-(O-ethoxycarbonyl)oxime, 1,2-diphenyl-1,2-ethanedione-1-(O-n-propoxycarbonyl)oxime, or the like.

These compound (a) and compound (b) may also be incorporated together with other conventional photosensitizers as mentioned above.

The photosensitizer (III) is incorporated into the resin composition in an amount of 0.05 to 20% by

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weight, preferably 0.5 to 10% by weight, based on the whole weight of the resin composition.

In order to further increase the photocuring reaction-promoting activity of the photosensitizer (III), there may also be incorporated a photosensitizing auxiliary, such as amines (e.g. triethanolamine, triethylamine, N,N-diethylaminoethyl (meth)acrylate), phosphorous compounds (e.g. triphenylphosphine), or the like.

When the ultraviolet curable resin composition of the present invention is incorporated with a divalent or more polyvalent organic isocyanate compound in addition to the saturated copolyester (I), polymerizable compound (II) and photosensitizer (III), it shows excellent solvent resistance, particularly xylene resistance, as well as excellent adhesion, flexibility and processability.

Suitable examples of the organic isocyanate compound are 2,4-tolylenediisocyanate, 2,6-tolylenediisocyanate, isophoronediisocyanate, hexamethylenediisocyanate, xylylenediisocyanate, hydrogenated xylylenediisocyanate, diphenylmethane-4,4'-diisocyanate, Millionate MR (made by Nippon Polyurethane Kogyo), Collonate L (made by Nippon Polyurethane Kogyo), and further various terminal isocyanate group-containing compounds which are prepared by reacting an excess amount of the above-mentioned organic isocyanate compounds with low molecular weight active hydrogen compounds (e.g. ethylene glycol, propylene glycol, trimethylolpropane, glycerin, sorbitol, ethylenediamine, monoethanolamine, diethanolamine, triethanolamine), various high molecular weight active hydrogen compounds (e.g. polyether polyols, polyester polyols, polyamides), and further blocked organic isocyanate compounds which are prepared by blocking the above-mentioned terminal isocyanate group-containing compounds with a blocking agent, such as phenols (e.g. phenol, thiophenol, methylthiophenol, ethylphenol, cresol, xylenol, resorcinol, nitrophenol, chlorophenol), oximes (e.g. acetoxime, methyl ethyl ketoxime, cyclohexanone oxime), primary alcohols (e.g. methanol, ethanol, propanol, butanol), halogen-substituted alcohols (e.g. ethylene chlorohydrine, 1,3-dichloro-2-propanol), tertiary alcohols (e.g. tert-butanol, tert-pentanol), lactams (e.g. ε-caprolactam, δ-valerolactam, γ-butyrolactom, β-propiolactam), aromatic amines, imides, active methylene compounds, mercaptanes, imines, ureas, diaryl compounds, or the like. These divalent or more polyvalent organic isocyanate compounds are used in an amount of 0.1 to 20.0 parts by weight (0.1 to 20.0 PHR) per 100 parts by weight of the total weight of the saturated copolyester (I), polymerizable compound (II) and photosensitizer (III). In order to promote the effect of the organic isocyanate compound, there may also be incorporated a tin compound (e.g. dibutyl tin dilaurate) or an amine compound (e.g. triethylamine).

The ultraviolet curable resin composition of the present invention may also be incorporated with any conventional thermal polymerization inhibitor in order to prevent undesirable thermal polymerization during the preparation steps or undesirable dark reaction during storage of the composition. Suitable examples of the thermal polymerization inhibitor are hydroquinone, hydroquinone monomethyl ether, tert-butyl catechol, p-benzoquinone, 2,5-di-tert-butylhydroquinone, phenothiazine, or the like. The thermal polymerization inhibitors are usually incorporated in an amount of 0.0001 to 0.1% by weight, preferably 0.001 to 0.05% by weight, based on the weight of the polymerizable compound (II).

In accordance with the intended utility, the ultraviolet curable resin composition of the present invention may also be incorporated with various pigments, such as white pigments (e.g. titanium oxide, zinc white, white lead), black pigments (e.g. carbon black, lamp black, graphite), gray pigments (e.g. zinc powder, lead suboxide, slate dust), red pigments (e.g. cadmium red, cadmium-mercury red, red ocher), yellow pigments (e.g. cadmium yellow, zinc yellow, chrome yellow, titanium yellow), green pigments (e.g. viridian, chrome oxide green, cobalt green, chrome green), blue pigments (e.g. ultramerine blue, iron blue, cobalt blue), violet pigments (e.g. manganese violet, cobalt violet), iron oxide pigments (e.g. brown iron oxide, iron oxide black), extender pigments (e.g. calcium carbonate, barium sulfate, alumina, talc, clay), azo type organic pigments (e.g. permanent red 4R, Hansa yellow G, Hansa yellow 10 G, brilliant carmine 3B, brilliant carmine 6B), phthalocyanine organic pigments (e.g. phthalocyanine green, first sky blue), metallic powder pigments (e.g. silver pigments, copper pigment, gold pigment), glass powder, glass flake, glass bead, or the like.

Moreover, the ultraviolet curable resin composition may be incorporated with conventional lubricating agents, such as acrylic additives (e.g. Modaflow, made by Monsanto Co., or Polyflow S, made by Kyoeisha Yushi), silicone additives (e.g. Baysilone OL, made by Bayer, YF-3818, XF-3913, TSA-720, made by Toshiba Silicone), and further with synthetic resins other than the saturated copolyester (I) provided that the desired properties of the present composition are not deteriorated, for example, melamine resins, epoxy resins, phenoxy resins, polyurethane resins, polystyrene, polybutadiene, polyvinyl chloride, polyethylene, polypropylene, polyvinyl acetate, ethylene-vinyl acetate copolymer, styrene-butadiene copolymer, styrene-acrylonitrile copolymer, vinyl chloride-vinyl acetate copolymer, styrene-maleic anhydride copolymer, butadiene-maleic anhydride copolymer, or the like.

The ultraviolet curable resin composition can be coated or printed onto base materials by conventional coating or printing methods, followed by irradiating with ultraviolet light to start the photopolymerization reaction and then to cure the composition. The irradiation by ultraviolet light can be carried out with various light sources, such as a sun light, a chemical lamp, a low pressure mercury-vapor lamp, a high pressure mercury-vapor lamp, a carbon arc lamp, a xenon lamp, a metal halide lamp, or the like. The curing of the resin composition may also be carried out by thermal polymerization with organic peroxides or by irradiation with electron rays. In the latter case, the photosensitizer is not necessarily essential.

The ultraviolet curable resin composition of the present invention shows excellent adhesion, flexibility and processability which can not be shown by the conventional ultraviolet curable resins, and can be used for various utilities, such as inks, paints or as a binder for coating agents, which are used for glasses, pottery, metals, plastic products, films, coated metal plates, or the like.

Particularly, the ultraviolet curable resin composition is useful as inks for ultraviolet curable screen printing by being incorporated with various pigments as mentioned hereinbefore.

The ultraviolet curable resin composition is also useful as a binder for the preparation of various laminated products of various metals, coated metals, plastics, films, glasses, pottery, fiber products. Among the base materials for the laminated products, at least one should have ultraviolet transparency. For example, transparent plastics, films or glasses are preferably used as a base material. Thus, the preferred laminated products can be prepared by laminating a base material such as metals, coated metals, plastics, films, glasses, pottery or fiber products with a transparent base material such as transparent plastics, films or glasses. The laminated products can be prepared by coating the ultraviolet curable resin composition onto one of the base materials, piling up another base material on the coating layer, and then irradiating with ultraviolet from the side of the transparent base material so as to cure the resin composition. Alternatively, the resin composition is coated onto a base material and irradiated with ultraviolet so that the resin composition is semicured, and then another base baterial is piled thereon, and the resin composition is completely cured by irradiation with ultraviolet.

The ultraviolet curable resin composition of the present invention is also useful for the preparation of a transfer paper for decorating pottery. The transfer paper for decorating pottery comprises a base paper, a design layer of ink and a cover coat. The ultraviolet curable resin composition is used for preparing the design layer of ink. When the ink layer is formed by the present ultraviolet curable resin composition, the transfer paper for decorating potteries shows superior calcining properties to the conventional solvent type transfer paper and further has the following characteristics:

(1) Fine design can be printed with good reproducibility without clogging of the screen printing plate, and hence, a high grade decoration can be obtained.

(2) The thickness of the design layer of ink can be made constant, and hence, calcination can uniformly be done.

(3) Because of the excellent flexibility of the ultraviolet curable resin composition, the resin does not scatter together with pigments during the thermal decomposition to give uniform calcination.

In order to use as an ink, the ultraviolet curable resin composition is incorporated with heat resistant inorganic pigments suitable for decorating the potteries. Suitable examples of the heat resistant inorganic pigments are magnesia, alumina, titania, tin oxide, antimony oxide, platinum, palladium, chromium oxide, cobalt oxide, manganese oxide, cerium oxide, nickel oxide, iron oxide, copper oxide, vanadium stannate, lead chromate, uranium yellow, cadmium sulfide, gold, iron titanate, uranium titanate, cadmium-selenium red, cobalt titanate, gold chloride, manganese sulfate, vanadium pentoxide. In order to promoate uniform coloring, there may also be incorporated with conventional flit or flux composed of various metal oxides such as Li_2O, Na_2O, K_2O, MgO, CaO, BaO, ZnO, PbO, B_2O_3, Al_2O_3, SiO_2.

The layer of the cover coat of the transfer paper may be formed with the conventional solvent type (meth)acrylic resin (e.g. OPL-100, made by Kyoeisha Yushi), but is preferably formed with an ultraviolet curable resin composition comprising a (meth)acrylic ester polymer, polymerizable compound and a photosensitizer. The (methacrylic ester polymer is a homopolymer or copolymer of a compound of the formula:

$$CH_2=\overset{\displaystyle R_1}{\overset{|}{C}}-COOR_2$$

wherein R_1 is hydrogen or methyl, and R_2 is an alkyl, aralkyl or aryl group having 1 to 20 carbon atoms. Suitable examples of the polymer are methyl methacrylate-ethyl methacrylate copolymer, methyl methacrylate-propyl methacrylate copolymer, methyl methacrylate-butyl methacrylate copolymer, which have a molecular weight of 1,000 to 1,000,000 preferably 20,000 to 800,000. The polymerizable compound may be the same as mentioned hereinbefore, but is preferably methacrylate compounds (rather than acrylate compounds), and the compound is not required to have two or more double bonds in the molecule, but rather, the preferred polymerizable compounds may have only single polymerizable double bond. The (meth)acrylic ester copolymer and the polymerizable compound are incorporated in the weight ratio of (meth)acrylic ester polymer:-polymerizable compound=5:95 to 90:10, preferably 20:80 to 80:20. Besides, the photosensitizer is the same as mentioned hereinbefore and is used in an amount of 0.5 to 20% by weight, preferably 1 to 10% by weight, based on the whole weight of the resin composition.

These ultraviolet curable resin compositions used for the ink layer and the cover coat layer may also be incorporated with other conventional thermal polymerization inhibitors, leveling agents, defoaming agents, thickening agents, thixotropic agents in order to control the viscosity, stability and printing properties.

The base paper used for the transfer paper may be conventional simple paper, collodion-coated paper, separate paper, thermaflat paper.

The transfer papers for decorating pottery are useful for decorating various products such as pottery, porcelains, glasses, tiles, ceramics, or the like.

The present invention is illustrated by the following Preparations and Examples, but is not limited thereto.

In the Preparations and Examples, "part" means part by weight unless specified otherwise, and various properties were measured in the following manner.

(1) % by mole of the components in polyesters: by NMR analysis (solvent; $CDCl_3$)

(2) Molecular weight: by vapor pressure depression method

(3) Pencil hardness of the cured coating layer: by the method as described in JIS K 5400

(4) Adhesion: by the method as described in ASTM D-3359

(5) Gloss of the cured coating layer: it was measured with a glossmeter (Type-VG 107, made by Nippon Denshoku Kogyo K.K.) at an angle of 60°.

(6) Water resistance of printed matter: the printed matter was dipped in water at 25° C., and thereafter, the change of appearance was observed.

(7) Alcohol resistance: the product to be tested was rubbed with a gauze impregnated with methanol 50 times, and thereafter, the change of appearance was observed.

(8) Solvent (xylene) resistance: the product to be tested was rubbed with a gauze impregnated with xylene until the substrate appeared, and the time of rubbing was calculated.

Preparation 1

A stainless steel autoclave provided with a stirrer, a thermometer and a partial reflux condenser was charged with dimethyl terephthalate (194 parts), dimethyl isophthalate (194 parts), ethylene glycol (191 parts), 1,6-hexanediol (156 parts) and tetra-n-butyl titanate (0.25 part), and the mixture was gradually heated until 220° C. and then reacted at 220° C. for 2 hours. After the pressure was gradually reduced, the mixture was reacted under reduced pressure (10 mmHg) at 260° C for one hour to give a saturated copolyester (A). The saturated copolyester (A) had a molecular weight of 3,900 and had a composition of (measured by NMR) polycarboxylic acid components: terephthalic acid, 50% by mole and isophthalic acid, 50% by mole, and polyvalent alcohol components: ethylene glycol, 40% by mole and 1,6-hexanediol, 60% by mole.

In the same manner as described above, various saturated copolyesters (B to E) as shown in Table 1 were prepared.

TABLE 1

Components	Saturated copolyesters				
(% by mole)	A	B	C	D	E
Polycarboxylic acid components:					
Terephthalic acid	50	45	40	50	50
Isophthalic acid	50	40	50	50	40
Adipic acid	—	—	10	—	—
Sebacic acid	—	15	—	—	10
Polyvalent alcohol components.					
Ethylene glycol	40	50	52	45	48
Propylene glycol	—	—	—	55	—
Neopentyl glycol	—	50	48	—	—
1,6-Hexanediol	60	—	—	—	52
Molecular weight	3,900	4,200	4,600	3,500	3,800

Preparation 2

Into the same reactor as used in Preparation 1 were charged adipic acid (292 parts), ethylene glycol (125 parts), 1,4-butanediol (89 parts) and tetra-n-butyl titanate (0.25 part), and the mixture was gradually heated to 220° C. and was reacted at 220° C. for one hour. After the pressure was gradually reduced, the mixture was reacted under reduced pressure (0.3 mmHg) at 220° C. for one hour and 5 minutes to give a saturated copolyester (F). The copolyester (F) had a molecular weight of 4,900 and had a composition of polycarboxylic acid component: adipic acid, 100% by mole and polyvalent alcohol components: ethylene glycol, 57% by mole and 1,4-butanediol, 43% by mole.

Preparation 3

The above Preparation 2 was repeated except that adipic acid (248 parts) and isophthalic acid (50 parts) were used instead of adipic acid (292 parts) to give a saturated copolyester (G). The saturated copolyester (G) had a molecular weight of 4,500 and had a composition of polycarboxylic acid components: adipic acid, 85% by mole and isophthalic acid, 15% by mole, and polyvalent alcohol components: ethylene glycol, 58% by mole and 1,4-butanediol, 42% by mole.

Preparation 4

A stainless steel autoclave provided with a stirrer, a thermometer and a partial reflux condenser was charged with terephthalic acid (149 parts), isophthalic acid (133 parts), sebacic acid (61 parts), ethylene glycol (121 parts), neopentyl glycol (109 parts) and tetra-n-butyl titanate (0.41 part), and the mixture was reacted at 240° C. under a pressure of 3 kg/cm^{2}G. After the pressure was gradually reduced, the mixture was reacted under reduced pressure (lower than 0.2 mmHg) at 260°-270° C. for 2 hours to give a saturated copolyester (H). The saturated copolyester had a molecular weight of 19,000 and had a composition of polycarboxylic acid components: terephthalic acid 45% by mole, isophthalic acid, 40% by mole and sebacic acid, 15% by mole, and polyvalent alcohol components: ethylene glycol, 47% by mole and neopentyl glycol, 53% by mole.

Preparation 5

In the same manner as described in Preparation 1 except that the starting materials (components) as shown in Table 2 were used, there were prepared saturated copolyester (I to M) as shown in Table 2.

TABLE 2

Components	Saturated copolyesters				
(% by mole)	I	J	K	L	M
Polycarboxylic acid components					
Terephthalic acid	50	50	50	50	45
Isophthalic acid	50	50	50	50	40
Adipic acid	—	—	—	—	—
Sebacic acid	—	—	—	—	15
Polyvalent alcohol components:					
Ethylene glycol	40	40	39	40	49
Propylene glycol	—	—	—	—	—
Neopentyl glycol	—	—	—	—	—
1,6-Hexanediol	60	60	61	60	51
Molecular weight	3,200	3,400	2,240	4,900	4,250

Preparation 6

Into the same reactor as used in Preparation 1 were charged dimethyl terephthalate (190 parts), dimethyl isophthalate (188 parts), ethylene glycol (191 parts), 1,6-hexanediol (156 parts) and tetra-n-butyl titanate (0.25 part), and the mixture was gradually heated to 220° C., and was reacted at 220° C. for 2 hours. To the resulting mixture was added 5-sodium sulfoisophthalic acid (13.5 parts), and the mixture was reacted at 220° to 260° C. for one hour. The mixture was further reacted under reduced pressure (10 mmHg) at 260° C. for one hour to give a saturated copolyester (N). The saturated copolyester (N) had a molecular weight of 3,500 and had a composition of polycarboxylic acid components: terephthalic acid, 49.0% by mole, isophthalic acid, 48.5% by mole and 5-sodium sulfoisophthalic acid, 2.5% by mole, and polyvalent alcohol components: ethylene glycol, 40% by mole, 1,6-hexanediol, 60% by mole.

EXAMPLE 1

The saturated copolyester (A) (50 parts) prepared in Preparation 1, a polymerizable compound (50 parts) as shown in Table 3, benzoin ethyl ether (3 parts, as a photosensitizer), and hydroquinone (0.01 part, as a thermal polymerization inhibitor) were mixed and dissolved by heating at 80° C. to give ultraviolet curable resin compositions (X-1 to X-11) which were a transparent solution.

The resin compositions thus prepared were each coated onto a non-treated polyethylene terephthalate

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film (thickness: 125μ) and a non-treated soft steel panel (provided in JIS G-3141) with a bar coater #20 and thereafter were irradiated with a 5.6 KW high pressure mercury-vapor lamp at a height of 15 cm for 30 seconds to give a transparent cured coating layer. The properties of the cured coating layer were measured. The results are shown in Table 3.

TABLE 3

Resin comp No	Saturated copolyester (A) (parts)	Polymerizable compound (parts)		Viscosity (poise)	Pencil hardness	Adhesion: Polyethylene terephthalate film	Adhesion: Soft steel panel
X-1	50	Styrene Phenoxyethyl methacrylate Ethylene glycol dimethacrylate	20 10 20	33.2	HB	100/100	100/100
X-2	50	Styrene Ethylene glycol dimethacrylate	30 20	17.5	HB	100/100	100/100
X-3	50	Styrene Ethylene glycol dimethacrylate 1,6-Hexanediol diacrylate	15 15 20	32.0	F	100/100	100/100
X-4	50	Tetrahydrofurfuryl acrylate Ethylene glycol dimethacrylate	25 25	69.0	F	100/100	100/100
X-5	50	Styrene Tetrahydrofurfuryl acrylate Ethylene glycol dimethacrylate	10 15 25	48.0	F	100/100	100/100
X-6	50	Tetrahydrofurfuryl acrylate Neopentylglycol diacrylate	25 25	123.0	H	100/100	100/100
X-7	50	Tetrahydrofurfuryl acrylate 1,6-Hexanediol diacrylate	25 25	96.8	H	100/100	100/100
X-8	50	Styrene Trimethylolpropane triacrylate	35 15	25.2	F	100/100	100/100
X-9	30	Styrene Ethylene glycol dimethacrylate	50 20	8.1	B	100/100	100/100
X-10	40	Styrene Ethylene glycol dimethacrylate	40 20	10.8	B	100/100	100/100
X-11	60	Styrene Ethylene glycol dimethacrylate	20 20	57.8	HB	100/100	100/100
Reference	—	Styrene 1,6-Hexanediol diacrylate Trimethylolpropane triacrylate	50 40 10	<1	It was very slowly cured. Tackiness was not lost Adhesion was inferior.		

EXAMPLE 2

In the same manner as described in Example 1 except that the saturated copolyesters (B to E) were used, there were prepared ultraviolet curable resin compositions (X-12 to X-15), and coating layers therefrom. The results are shown in Table 4.

For comparison purpose, the example was repeated except that the saturated copolyesters (F and G) prepared in Preparations 2 and 3 were used. The results are also shown in Table 4.

TABLE 4

Resin comp. No.	Saturated copolyester (parts)		Polymerizable compound (parts)		Viscosity (poise)	Pencil hardness	Adhesion: Polyethylene terephthalate film	Adhesion: Soft steel panel
X-12	B	50	Tetrahydrofurfuryl acrylate Ethylene glycol dimethacrylate	25 25	61.3	B	100/100	100/100
X-13	C	50	Tetrahydrofurfuryl acrylate Ethylene glycol dimethacrylate	25 25	84.2	B	100/100	100/100

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TABLE 4-continued

Resin comp. No.	Saturated copoly-ester (parts)		Polymerizable compound (parts)		Vis-cosity (poise)	Pencil hard-ness	Adhesion Polyethylene terephthalate film	Adhesion Soft steel panel
X-14	D	50	Tetrahydrofurfuryl acrylate	25	83.6	HB	100/100	100/100
			Ethylene glycol dimethacrylate	25				
X-15	E	50	Tetrahydrofurfuryl acrylate	25	71.8	HB	100/100	100/100
			Ethylene glycol dimethacrylate	25				
X-16	E	50	Tetrahydrofurfuryl acrylate	30				
			Ethylene glycol dimethacrylate	15	79.0	F	100/100	100/100
			Trimethylolpropane triacrylate	5				
Refer-ence	F	50	Tetrahydrofurfuryl acrylate	25	9.8	5B	0/100	0/100
			Ethylene glycol dimethacrylate	25				
Refer-ence	G	50	Tetrahydrofurfuryl acrylate	25	15.8	4B	0/100	0/100
			Ethylene glycol dimethacrylate	25				

REFERENCE EXAMPLE 1

The saturated copolyester (H) (50 parts) prepared in Preparation 4, tetrahydrofurfuryl acrylate (20 parts), styrene (10 parts), ethylene glycol dimethacrylate (20 parts), benzoin ethyl ether (3 parts) and hydroquinone (0.01 part) were stirred at 80° C., but they showed inferior solubility and a homogeneous solution could not be obtained.

EXAMPLE 3

The saturated copolyester (A) (50 parts) prepared in Preparation 1 was dissolved at 80° C. in a mixture of tetrahydrofurfuryl acrylate (25 parts), neopentyl glycol diacrylate (25 parts), trimethylolpropane triacrylate (3 parts), diacrylate of bisphenol A ethylene oxide (4 mole) adduct (2 parts) and hydroquinone monomethyl ether (0.02 part), and therein was further dissolved benzoin ethyl ether (6 parts) to give an ultraviolet curable resin composition (X-17) of the present invention.

The resin composition thus obtained (85 parts) and titanium dioxide (15 parts) were well kneaded with a three roll mill to give an ultraviolet curable ink composition. By using this ink composition, a non-treated tinplate (thickness: 0.3 mm) with a 270 mesh screen printing plate, and then the resulting plate was irradiated with a 5.6 KW mercury vapor lamp at a height of 12 cm for 15 seconds. The coating layer had the following properties:

Pencil hardness: H

Adhesion: 100/100

Besides, this printed tinplate was bent at 180°, but there was not observed any peeling or breaking of the printed coating layer.

EXAMPLES 4 TO 8

The saturated copolyester (A) (50 parts), a polymerizable compound (50 parts) as shown in Table 5 and hydroquinone (0.01 part) were mixed well at 80° C. to give a resin composition. The resin composition (90 parts), carbon black (5 parts), a silicone additive (0.1 part) and photosensitizers: 2-methylthioxanthone (2.5 parts) and 1-phenyl-1,2-propanedione-2-(O-ethoxycarbonyl) oxime (2.5 parts) were kneaded with a three roll mill to give an ultraviolet curable ink composition.

By using this ink composition, a non-treated polyethylene terephthalate film (thickness: 125μ) was printed with a 270 mesh screen printing plate in a thickness of the coating layer of about 15μ, and then the printed plate was irradiated with a 5.6 KW high pressure mercury vapor lamp at a height of 15 cm. The curing rate of the coating layer and the properties of the coating layer were measured. The results are shown in Table 5.

TABLE 5

Ex. No.	Polymerizable compounds (parts)		Curing rate (sec)	Properties of the cured coating layer Adhesion	Pencil hardness	Reflectance of surface gloss (%)
4	Tetrahydrofurfuryl acrylate	25	3.8	100/100	F	96
	Neopentyl glycol diacrylate	25				
5	Tetrahydrofurfuryl acrylate	30	3.9	100/100	F	96
	1,6-Hexanediol diacrylate	20				
6	Phenoxyethyl methacrylate	5				
	Tetrahydrofurfuryl acrylate	25	4.2	100/100	HB	89
	1,4-Butanediol diacrylate	20				
7	Tetrahydrofurfuryl acrylate	20				
	1,6-Hexanediol diacrylate	20	3.6	100/100	F	94
	Bisphenol A ethylene oxide adduct diacrylate	10				
8	Cyclohexyl methacrylate	5				
	Tetrahydrofurfuryl acrylate	20	4.8	100/100	H	87
	Neopentyl glycol diacrylate	10				

TABLE 5-continued

Ex. No.	Polymerizable compounds (parts)		Curing rate (sec.)	Properties of the cured coating layer: Adhesion	Pencil hardness	Reflectance of surface gloss (%)
	Trimethylolpropane triacrylate	5				

EXAMPLES 9 TO 13

The saturated copolyester (A, I, J, K or L) (50 parts), tetrahydrofurfuryl acrylate (30 parts), 1,6-hexanediol diacrylate (20 parts), and hydroquinone monomethyl ether (0.01 part) were stirred at 80° C. to give a transparent, homogeneous solution. The viscosity of the solution was measured. The results are shown in Table 6.

The solution obtained above (90 parts), brilliant carmine 6B (5 parts), benzoin ethyl ether (6 parts) and a silicone additive (0.1 part) were kneaded well with a three roll mill to give an ultraviolet curable ink composition for screen printing. By using the ink composition, a non-treated polyethylene terephthalate film (thickness: 125μ) was printed with a 300 mesh polyethylene polyester screen printing plate and the printed plate was irradiated with a 5.6 KW high pressure mercury vapor lamp at a height of 12 cm for 8 seconds to give a cured coating layer. The properties of the cured coating layer were measured. The results are shown in Table 6.

All ink compositions showed excellent release characteristics and leveling and hence had practical printing properties.

TABLE 6

Ex. No	Saturated copolyester	Viscosity of solution at 25° C. (poise)	Properties of cured coating layer: Pencil hardness	Adhesion	Water resistance	Alcohol resistance
9	A	110	F	100/100	Excellent	Excellent
10	I	62	F	"	"	"
11	J	71	F	"	"	"
12	K	23	HB	"	"	"
13	L	230	HB	"	"	"

EXAMPLES 14 TO 17

In the same manner as described in Example 9 except that the saturated copolyesters (E, D, M and C) were used, various ultraviolet curable ink compositions were prepared.

By using the ink compositions, a non-treated polyethylene terephthalate film (thickness: 125μ) was printed in the same manner as described in Example 9, and the printed plate was irradiated with a 5.6 KW high pressure mercury vapor lamp at a height of 12 cm for 8 seconds to give a cured coating layer. The properties of the cured coating layer were measured. The results are shown in Table 7.

All ink compositions showed excellent release characteristics and leveling and hence had practical printing properties.

TABLE 7

Ex No	Saturated copolyester	Pencil hardness	Adhesion	Water resistance	Alcohol resistance
14	E	HB	100/100	Excellent	Excellent
15	D	HB	"	"	"
16	M	F	"	"	"
17	C	F	"	"	"

EXAMPLES 18 TO 22

The saturated copolyester (A) was mixed with a polymerizable compound as shown in Table 8 in various ratio to give transparent homogeneous solutions. The viscosity of the solutions was measured. The results are shown in Table 8.

The solution (90 parts), titanium oxide (12 parts), benzoin isopropyl ether (9 parts) and a silicone additive (0.1 part) were kneaded well with a three roll mill to give an ultraviolet curable ink composition for screen printing.

By using the ink composition obtained above, a non-treated tinplate (thickness: 0.3 mm) was printed with a 270 mesh polyester screen printing plate, and the printed plate was irradiated with a 5.6 KW high pressure mercury vapor lamp at a height of 12 cm to give a cured coating layer. The properties of the cured coating layer were measured. For comparison purposes, an ink composition was prepared in the same manner as described above except that the saturated copolyester (A) was not used, and a cured coating layer was formed likewise. The properties of this cured coating layer were also measured. These results are shown in Table 8.

TABLE 8

Ex No	Saturated copolyester (A) and polymerizable compounds (part)		Viscosity of solution at 25° C. (poise)	Properties of cured coating layer: Pencil hardness	Adhesion	Water resistance	Alcohol resistance
18	(A)	50					
	THF—A	25	112	F	100/100	Excellent	Excellent
	1,6-HX—A	25					
19	(A)	50					
	THF—A	30	98	F	100/100	"	"
	NPG—A	20					
20	(A)	40					
	THF—A	30	105	F	100/100	"	"
	BP—4EA	30					
21	(A)	30					
	THF—A	35	24	HB	100/100	"	"
	BP—4EA	35					
22	(A)	50					

TABLE 8-continued

Ex No	Saturated copolyester (A) and polymerizable compounds (part)		Viscosity of solution at 25° C. (poise)	Properties of cured coating layer: Pencil hardness	Adhesion	Water resistance	Alcohol resistance
	THF—A	30	125	F	100/100	"	"
	1,6-HX—A	15					
	TMP—A	5					
Ref.	THF—A	50	<0.1	B	0/100	It was cured very slowly. Tackiness was not disappeared.	
	1,6-HX—A	50					
	BP—4EA	100	11	HB	0/100	It was cured very slowly. Tackiness was not disappeared.	
	THF—A	50	0.3	HB	0/100	It was cured very slowly. Tackiness was not disappeared.	
	BP—4EA	50					

[Remarks]:
THF—A Tetrahydrofurfuryl acrylate
NPG—A Neopentyl glycol diacrylate
TMP—A Trimethylolpropane triacrylate
1,6-HX—A 1,6-Hexanediol diacrylate
BP—4EA Diacrylate of bisphenol A ethylene oxide (4 mole) adduct

REFERENCE EXAMPLES 2 AND 3

In the same manner as described in Example 9 except that the saturated copolyesters (F and G) were used, a non-treated polyethylene terephthalate film (thickness: 125μ) was printed and the properties of the cured coating layer were measured. The results are shown in Table 9.

The ink compositions of the reference examples showed a comparatively lower viscosity, and hence had good leveling and release characteristics, but the properties of the coating layer were inferior from the practical viewpoints as shown in Table 9.

TABLE 9

Ref Ex. No	Saturated copolyester	Viscosity of solution at 25° C. (poise)	Properties of cured coating layer: Pencil hardness	Adhesion	Water resistance	Alcohol resistance
2	F	12	5B	0/100	Peeled	Peeled
3	G	21	4B	0/100	"	"

EXAMPLE 23 AND REFERENCE EXAMPLE 4

The saturated copolyester (A) (50 parts), tetrahydrofurfuryl acrylate (47 parts), 1,6-hexanediol diacrylate (3 parts) and hydroquinone monomethyl ether (0.01 part) were mixed and dissolved at 80° C., and thereto was added benzoin isopropyl ether (2 parts) to give an ultraviolet curable adhesive.

The ultraviolet curable adhesive thus obtained was coated onto a soft steel panel (thickness: 0.8 mm) in a thickness of about 50μ, and thereon a non-treated polyethylene terephthalate film (thickness: 125μ) was laminated, and the resulting laminated product was irradiated with a 5.6 KW high pressure mercury vapor lamp at a height of 15 cm for 5 seconds from the side of the polyethylene terephthalate film to give a cured laminated product. The laminated product adhered strongly, and the polyethylene terephthalate film could hardly be peeled off without breaking of the film.

As the reference, an ultraviolet curable adhesive was prepared in the same manner as described above except that the saturated copolyester (A) was not used, and a laminated product was prepared likewise by using the adhesive. As the result, the polyethylene terephthalate film could easily be peeled off with hand. Thus, the adhesion of the laminated product was very inferior.

EXAMPLE 24

The saturated copolyester (C) (50 parts), tetrahydrofurfuryl acrylate (30 parts), neopentyl glycol diacrylate (20 parts) and hydroquinone monomethyl ether (0.01 part) were mixed and dissolved at 80° C., and thereto was added benzoin ethyl ether (3 parts) to give an ultraviolet curable adhesive.

The ultraviolet curable adhesive thus obtained was coated onto a transparent polycarbonate plate (thickness: 1 mm) and thereon the same polycarbonate plate was laminated. The laminated product was irradiated under the same conditions as in Example 23 from both sides for 10 seconds to give a laminated product which was strongly adhered.

EXAMPLE 25

The saturated copolyester (D) (50 parts), tetrahydrofurfuryl acrylate (30 parts), hydroxyethyl acrylate (5 parts), phenoxyethyl acrylate (5 parts), ethylene glycol dimethacrylate (10 parts) and hydroquinone (0.01 part) were mixed and dissolved at 80° C. to give a resin.

The resin thus obtained (94 parts), brilliant carmine 6B (2 parts), benzoin ethyl ether (6 parts) and a silicone additive (0.5 part) was kneaded well with a three-roll mill to give a colored ultraviolet curable adhesive.

The adhesive thus obtained was coated onto a glass plate (thickness: 2 mm) and thereof the same glass plate was laminated. The laminated product was irradiated from both sides under the same conditions as in Example 24 for 20 seconds to give a colored laminated glass which was strongly adhered.

REFERENCE EXAMPLE 5

In the same manner as described in Example 23 except that the saturated copolyesters (F and G) were used instead of the saturated copolyester (A), there were prepared ultraviolet curable adhesives. By using these adhesives, it was tried to adhere a polyethylene terephthalate film (thickness: 125μ) and a soft steel panel under the same conditions as in Example 23, but in both cases, the laminated product was easily peeled by hand.

REFERENCE EXAMPLE 6

The saturated copolyester (H) (50 parts), tetrahydrofurfuryl acrylate (47 parts), 1,6-hexanediol diacrylate (3 parts) and hydroquinone monomethyl ether (0.01 part)

were mixed and stirred at 80° C., but there could not be prepared a homogeneous solution. Besides, when some saturated copolyesters: Vylon 200, Vylon 30P and Vylon 500 (made by Toyo Boseki K. K.) were used instead of the saturated copolyester (H) in the above procedure, the same results were obtained.

EXAMPLE 6

The saturated copolyesters (A) (50 parts), tetrahydrofurfuryl acrylate (25 parts), neopentyl glycol diacrylate (25 parts) and hydroquinone monomethyl ether (0.01 part) were mixed and dissolved at 80° C., and the mixture was cooled to room temperature and thereto was added benzoin ethyl ether (5 parts) to give an ultraviolet curable resin. To this resin was added an organic isocyanate compound as shown in Table 10 to give an ultraviolet curable resin composition.

The resin composition thus obtained was coated onto a non-treated polyethylene terephthalate film (thickness: 125μ) with a bar coater #20, and the coated product was irradiated with a 5.6 KW high pressure mercury vapor lamp at a height of 15 cm for 10 seconds to give a cured coating layer. The properties of the cured coating layer were measured. The results are shown in Table 10. The coating layer showed inferior xylene resistance immediately after being cured, but after being kept at room temperature, it showed extremely improved xylene resistance.

TABLE 10

Organic isocyanate compound		Properties of the cured coating layer			
		Immediately after being cured.		After being kept at room temperature for 10 days	
Kind	Amount (PHR)	Adhesion	Xylene resistance	Adhesion	Xylene resistance
Collonate L*	1.0	100/100	5	100/100	25
	3.0	"	4	"	32
	5.0	"	4	"	> 100
	7.0	"	4	"	> 100
Millionate MR*	1.0	100/100	5	100/100	43
	3.0	"	5	"	72
	5.0	"	4	"	> 100
	7.0	"	4	"	> 100

*Both products are made by Nippon Polyurethane Kogyo K K

EXAMPLE 7

The saturated copolyester (N) (50 parts), tetrahydrofurfuryl acrylate (25 parts), 1,6-hexanediol diacrylate (25 parts), benzoin ethyl ether (3 parts) and hydroquinone (0.01 part) were mixed and dissolved at 80° C. to give an ultraviolet curable resin composition. In the same manner as described above, various ultraviolet curable resin compositions were prepared by using various polymerizable compounds as shown in Table 11.

The resin compositions were coated onto a non-treated polyethylene terephthalate film (thickness: 125μ) and a non-treated soft steel panel with a bar coater #20, and the coated products were irradiated with a 5.6 KW high pressure mercury vapor lamp at a height of 15 cm for 30 seconds to give a transparent cured coating layer. The properties of the cured coating layer were measured. The results are shown in Table 11.

TABLE 11

Run No.	Saturated copolyester (N) (part)	Polymerizable compounds (part)		Viscosity (poise)	Pencil hardness	Adhesion	
						Polyethylene terephthalate film	Soft steel panel
1	50	THF—A	25	180.2	F	100/100	100/100
		1,6-HX—A	25				
2	50	THF—A	25	192.1	F	100/100	100/100
		NPG—A	25				
3	50	THF—A	30	176.6	HB	100/100	100/100
		NPG—A	20				
4	50	THF—A	20	186.5	HB	100/100	100/100
		PE—MA	5				
		1,6-HX—A	25				
5	40	THF—A	30	185.7	F	100/100	100/100
		BP—4EA	30				

[Remarks]
THF—A: Tetrahydrofurfuryl acrylate,
1,6-HX—A 1,6-Hexanediol diacrylate
NPG—A Neopentyl glycol diacrylate,
PE—MA Phenoxyethyl methacrylate,
BP—4EA. Diacrylate of bisphenol A ethylene oxide (4 mole adduct

EXAMPLE 8

The saturated copolyester (A) (45 parts) was dissolved at 80° C. in a mixture of tetrahydrofurfuryl acrylate (30 parts), diacylate of bisphenol A ethylene oxide (4 mole) adduct (30 parts), 1,6-hexanediol diacrylate (5 parts) and hydroquinone monomethyl ether (0.02 part), and therein was further dissolved benzoin ethyl ether (7 parts) to give an ultraviolet curable resin composition.

The resin composition thus obtained (85 parts), titanium dioxide (13 parts) and an acrylic lubricating agent (2 parts) were kneaded well with a three roll mill to give an ultraviolet curable ink composition.

By using this ink composition, various materials were printed with a 300 mesh screen printing plate, and the printed products were irradiated with a 5.6 KW high pressure mercury vapor lamp at a height of 12 cm for 15 seconds to give a cured coating layer. The properties of

the coating layer were measured. The results are shown in Table 12.

Besides, the ink composition obtained above was added in a glass vial (volume: 100 ml). The vial was sealed and was kept at 25° C. in dark place, and then, the storage stability of the ink composition was evaluated. The results are also shown in Table 12.

TABLE 12

Properties	Results
Adhesion onto various materials:	
Polyethylene terephthalate film (thickness. 125μ)	100/100
Polyethylene terephthalate molded plate (thickness 2 mm)	100/100
Polycarbonate plate (thickness: 1 mm)	100/100
Non treated soft steel panel (thickness 0.8 mm)	100/100
Non treated tinplate (thickness: 0.3 mm)	100/100
Glass plate (thickness: 2 mm)	100/100
Storage stability at 25° C.	
After 20 days	Not changed
After 40 days	"
After 60 days	"

EXAMPLE 9

The saturated copolyester (A) (30 parts), tetrahydrofurfuryl acrylate (17.5 parts), 1,6-hexanediol diacrylate (17.5 parts), diacrylate of bisphenol A ethylene oxide (4 moles) adduct (35 parts) and hydroquinone (0.01 part) were mixed and dissolved at 80° C., and thereto was added benzoin ethyl ether (3 parts) to give an ultraviolet curable resin composition (Run No. 1) which had a viscosity of 120 poise.

The resin composition was coated onto a non-treated polyethylene terephthalate film (thickness: 150μ) with a bar coater #20, and the coated film was irradiated with a 5.6 KW high pressure mercury vapor lamp at a height of 15 cm for 15 seconds to give a cured coating layer. The properties of the cured coating layer were measured. The results are shown in Table 13.

In the same manner as described above except that various polymerizable compounds as shown in Table 13 were used, there were prepared various ultraviolet curable resin compositions (Run Nos. 2 to 7), and curing coating layers were prepared therefrom and properties thereof were measured likewise. The results are also shown in Table 13.

EXAMPLE 30

The saturated copolyester (A) (40 parts), benzoin isopropyl ether (4 parts), selenium red (60 parts) and a leveling agent (2 parts) were kneaded with a three-roll mill to give an ultraviolet curable ink composition.

Separately, methyl methacrylate-n-butyl methacrylate copolymer (molecular weight: 75,000, glass transition temperature: 50° C., 40 parts), hydroxyethyl methacrylate (55 parts), ethylene glycol dimethacrylate (5 parts) and benzoin methyl ether (10 parts) were mixed and dissolved at room temperature to give a transparent, homogeneous ultraviolet curable resin composition.

A simple paper coated with a dextrine solution was screen-printed with the above-prepared ultraviolet curable ink composition, and the printed paper was irradiated with a 5.6 KW high pressure mercury vapor lamp at a height of 15 cm for 10 seconds to give a cured coating layer. Onto the resulting printed paper, the above-prepared ultraviolet curable resin composition was printed as a cover coat, and the cover-coated paper was irradiated with ultraviolet under the same conditions as mentioned above to give a transfer paper for decorating pottery.

The transfer paper thus obtained was transferred onto a pottery by a wet process and was calcined by heating with raising temperature of 100° C./hour upto a miximum temperature of 850° C. As a result, beautiful decoration could be obtained without undesirable cracking or partial disappearance of design. During the calcination, the cover coat was lost at 380° to 450° C.

What is claimed is:

1. An ultraviolet curable resin composition which comprises

(I) a saturated copolyester having a molecular weight of 2,000 to 15,000 which is soluble in a polymerizable compound (II), 20% to 100% by mole of saturated polycarboxylic acid components of the saturated copolyester being an aromatic dicarboxylic acid, wherein 19 to 98% by mole of the aromatic dicarboxylic acid is terephthalic acid, and the glycol component of the saturated copolyester being 10 to 80% by mole of ethylene glycol and 90 to 20% by mole of an alkylene glycol selected from the group consisting of propylene glycol, butanediol, neopentylglycol and hexanediol;

TABLE 13

Run No.	Saturated copoly-ester (I)	Polymerizable compounds (II) (% by weight) (a)		(b)		(c)		Weight ratio of (I)/(II)	Adhesion	Xylene resistance
1	A	THF—A	25	1,6-HX—A	25	BP—4EA	50	30/70	100/100	>100
2	A	THF—A	25	NPG—A	25	BP—4EA	50	35/65	100/100	>100
3	A	THF—A	25	1,6-HX—A	20	BP—4EA	55	30/70	100/100	>100
4	A	THF—A	25	TMP—A	15	BP—4EA	60	30/70	100/100	>100
5	A	THF—A	25	TMP—A	15	BP—4EA E—A	50 10	35/65	100/100	>100
6	A	THF—A	20	1,6-HX—A TMP—A	20 5	BP—4EA	55	40/60	100/100	>100
7	A	THF—A	25	1,6-HX—A DP—HA	15 5	BP—4EA	55	35/65	100/100	>100

[Remarks]:
THF—A Tetrahydrofurfuryl acrylate,
1,6-HX—A. 1,6-Hexanediol diacrylate,
NPG—A Neopentyl glycol diacrylate,
TMP—A Trimethylolpropane triacrylate,
BP—4EA Diacrylate of bisphenol A ethylene oxide (4 moles) adduct,
E—A Epoxyacrylate 3002 (made by Kyoeisha Yushi),
DP—HA Dipentaerythritol hexaacrylate

(II) a polymerizable compound comprising 10 to 95% by weight of a compound having one polymerizable double bond in the molecule selected from the group consisting of (i) a styrene compound, (ii) a substituted or unsubstituted alkyl mono(meth)acrylate, (iii) a mono(meth)acrylate of a bisphenol A alkylene oxide adduct, (iv) a urethane modified mono(meth)acrylate, (v) an epoxy mono(methacrylate) and (vi) an oligo ester of a mono(meth)acrylate and 90 to 5% by weight of a compound having two or more polymerizable double bonds in the molecule selected from the group consisting of (vii) a substituted or unsubstituted alkylene glycol di(meth)acrylate, (viii) a di(meth)acrylate of a bisphenol A alkylene oxide adduct, (ix) a urethane modified di(meth)acrylate, (x) an epoxy di(meth)acrylate, (xi) an oligo ester of a di(meth)acrylate, (xii) a poly(meth)acrylate of a polyvalent aliphate alcohol having three or more hydroxyl groups, and (xiii) a urethane modified poly(meth)acrylate, and (III) a photosensitizer.

2. An ultraviolet curable resin composition according to claim 1, wherein the saturated copolyester (I) and the polymerizable compound (II) are incorporated in the weight ratio of 10:90 to 80:20.

3. An ultraviolet curable resin composition according to claim 1, wherein the photosensitizer (III) is incorporated in an amount of 0.05 to 20% by weight based on the total weight of the saturated copolyester (I) and the polymerizable compound (II).

4. An ultraviolet curable resin composition according to claim 1, wherein the saturated polycarboxylic acid components of the saturated copolyester (I) comprise 20 to 70% by mole of terephthalic acid and 80 to 30% by mole of isophthalic acid.

5. An ultraviolet curable resin composition according to claim 1, wherein the saturated polycarboxylic acid components of the saturated copolyester (I) comprise 20 to 70% mole of terephthalic acid and 80 to 30% by mole of an aliphatic dicarboxylic acid having 3 to 30 carbon atoms.

6. An ultraviolet curable resin composition according to claim 1, wherein the saturated polycarboxylic acid components of the saturated copolyester (I) comprise 19 to 98% by mole of terephthalic acid, 1 to 80% by mole of isophthalic acid and 80 to 1% by mole of an aliphatic dicarboxylic acid having 3 to 30 carbon atoms.

7. An ultraviolet curable resin composition according to claim 1, wherein the polyol components of the saturated copolyester (I) comprise 10 to 80% by mole of ethylene glycol and 90 to 20% by mole of an alkylene glycol selected from the group consisting of propylene glycol, butanediol, neopentyl glycol and hexanediol.

8. An ultraviolet curable resin composition according to claim 1, wherein the polyol components of the saturated copolyester (I) comprise 10 to 90% by mole of butanediol and 90 to 10% by mole of an alkylene glycol selected from the group consisting of propylene glycol, neopentyl glycol and hexanediol.

9. An ultraviolet curable resin composition according to claim 1, wherein the saturated polycarboxylic acid components of the saturated copolyester (I) contain 0.5 to 20% by mole of an aromatic dicarboxylic acid having a metal sulfonate group.

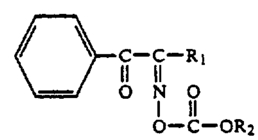
10. An ultraviolet curable resin composition according to claim 1, wherein the compound having one polymerizable double bond in the molecule is a member selected from phenoxyehtyl methacrylate and tetrahydrofurfuryl acrylate.

11. An ultraviolet curable resin composition accoring to claim 1, wherein the polymerizable compound (II) comprises (a) 10 to 70% by weight of a mono(meth)acrylate, (b) 5 to 50% by weight of one or more poly(meth)acrylate selected from the group consisting of a two or more poly(meth)acrylate having a molecular weight of smaller than 500, dipentaerythritol penta(meth)acrylate and dipentaerythritol hexa(meth)acrylate, and (c) 20 to 70% by weight of di(meth)acrylate having a molecular weight of larger than 500.

12. An ultraviolet curable resin composition according to claim 1, wherein the photosensitizer (III) is a member selected from the group consisting of benzoins, anthraquinones, benzophenones, sulfur-containing compounds and pigments.

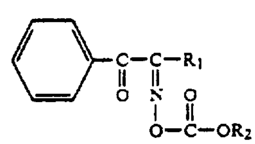
13. An ultraviolet curable resin composition according to claim 1, wherein the photosensitizer (III) is a member selected from the group consisting of xanthone, thioxanthone and their derivatives.

14. An ultraviolet curable resin composition according to claim 1, wherein the photosensitizer (III) is a compound of the formula:



wherein R_1 and R_2 are each a hydrocarbon group having 1 to 10 carbon atoms.

15. An ultraviolet curable resin composition according to claim 1, wherein the photosensitizer (III) is a combination of (a) a member selected from the group consisting of xanthone, thioxanthone and their derivatives, and (b) a compound of the formula:



wherein R_1 and R_2 are each a hydrocarbon group having 1 to 10 carbon atoms in the weight ratio of 4/1 to 1/4.

16. An ultraviolet curable resin composition according to claim 1, which is incorporated with one or more pigments suitable for screen printing or decorating potteries.

17. An ultraviolet curable resin composition according to claim 1, wherein the polymerizable compound (II) comprises 10 to 95% by weight of a compound selected from the group consisting of phenoxyethyl(meth)acrylate and tetrahydrofurfuryl(meth)acrylate and 90 to 5% by weight of a compound selected from the group consisting of a two or more poly(meth)acrylate having a molecular weight of smaller than 500, di(meth)acrylate of disphenol A ethylene oxide adduct, di(meth)acrylate of bisphenol A propylene oxide adduct, and dipentaerythritol hexa(meth)acrylate.

18. An ultraviolet curable resin composition according to claim 1, wherein the compound having one polymerizable double bond in the molecule is a member

selected from the group consisting of (ii) a substituted or unsubstituted alkyl mono(meth)acrylate, (v) an epoxy mono(meth)acrylate, and (vi) an oligo ester of a mono(-meth)acrylate.

19. An ultraviolet curable resin composition according to claim 18, wherein the compound having one polymerizable double bond is (ii) a substituted or unsubstituted alkyl mono(meth)acrylate.

20. An ultraviolet curable resin composition according to claim 1, wherein the compound having two or more polymerizable double bonds in the molecule is a member selected from the group consisting of (i) a substituted or unsubstituted alkylene glycol di(meth)acrylate, (ii) a di(meth)acrylate of bisphenol A alkylene oxide adduct, (iv) an epoxy di(meth)acrylate, and (vi) a poly(meth)acrylate of an at least trivalent aliphatic alcohol.

21. In a method of preparing laminated products the improvement which comprises employing as an adhesive a composition which comprises:

(I) a saturated copolyester having a molecular weight of 2,000 to 15,000 which is soluble in a polymerizable compound (II), 20% to 100% by mole of saturated polycarboxylic acid components of the saturated copolyester being an aromatic dicarboxylic acid, wherein 19 to 98% by mole of the aromatic dicarboxylic acid is terephthalic acid, and the glycol component of the saturated copolyester being 10 to 80% by mole of ethylene glycol and 90 to 20% by mole of an alkylene glycol selected from the group consisting of propylene glycol, butanediol, neopentylgylcol and hexanediol;

(II) a polymerizable compound comprising 10 to 95% by weight of a compound having one polymerizable double bond in the molecule selected from the group consisting of (i) a styrene compound, (ii) a substituted or unsubstituted alkyl mono(meth)acrylate, (iii) a mono(meth)acrylate of a bisphenol A alkylene oxide adduct, (iv) a urethane modified mono(meth)acrylate, (v) an epoxy mono(methacrylate) and (vi) an oligo ester of a mono(meth)acrylate and 90 to 5% by weight of a compound having two or more polymerizable double bonds in the molecule selected from the group consisting of (vii) a substituted or unsubstituted alkylene glycol di(meth)acrylate, (viii) a di(meth)acrylate of a bisphenol A alkylene oxide adduct, (ix) a urethane modified di(meth)acrylate, (x) an epoxy di(meth)acrylate, (xi) an oligo ester of a di(meth)acrylate, (xii) a poly(meth)acrylate of a polyvalent aliphate alcohol having three or more hydroxyl groups, and (xiii) a urethane modified poly(meth)acrylate, and

(III) a photosensitizer.

22. The method of claim 21 wherein the polymerizable compound (II) comprises 10 to 95% by weight of a compound selected from the group consisting of phenoxyethyl(meth)acrylate and tetrahydrofurfuryl(meth)acrylate and 90 to 5% by weight of a compound selected from the group consisting of a two or more poly(meth)acrylate having a molecular weight of smaller than 500, di(meth)acrylate of disphenol A ethylene oxide adduct, di(meth)acrylate of bisphenol A propylene oxide adduct, and dipentaerythritol hexa(meth)acrylate.

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W019214

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United States Patent [19]

Lange et al.

BEST AVAILABLE COPY

[11] **4,396,650**

[45] **Aug. 2, 1983**

[54] **PRIMED INORGANIC SUBSTRATES OVERCOATED WITH CURABLE PROTECTIVE COMPOSITIONS**

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[73] Assignee: **Minnesota Mining and Manufacturing Company**, St. Paul, Minn.

[21] Appl. No.: **385,790**

[22] Filed: **Jun. 7, 1982**

Related U.S. Application Data

[62] Division of Ser. No. 265,467, May 20, 1981, Pat. No. 4,356,233.

[51] **Int. Cl.**[3] **B05D 1/36**

[52] **U.S. Cl.** **427/409**; 427/53.1; 427/54.1; 427/407.1; 427/407.2; 427/410

[58] **Field of Search** 427/409, 410, 407.1, 427/407.2, 53.1, 54.1

[56] **References Cited**

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3,817,905	6/1974	Lerner et al.	260/37 R
4,042,749	9/1977	Sandvig	428/412
4,073,967	2/1978	Sandvig	427/44
4,084,021	4/1978	Sandvig	427/44
4,113,895	9/1978	Watt et al.	427/44
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Primary Examiner—Thurman Page
Attorney, Agent, or Firm—Cruzan Alexander; Donald M. Sell; Lorraine R. Sherman

[57] **ABSTRACT**

Primer compositions for adhering overcoatings derived from in situ polymerizations of uncured monomers onto inorganic substrates are disclosed. These primer compositions comprise at least one non-amino- or non-amido-containing silane, at least one of certain metal esters, and preferably an acidic material. The overcoatings are derived from epoxy and vinyl monomers. The primed and overcoated substrates of the present invention provide articles having protective, decorative, or other functional surface layers.

3 Claims, No Drawings

W019216

PRIMED INORGANIC SUBSTRATES OVERCOATED WITH CURABLE PROTECTIVE COMPOSITIONS

This is a division of application Ser. No. 265,467 filed May 20, 1981, now U.S. Pat. No. 4,356,233.

TECHNICAL FIELD

This invention relates to a composition and method for priming inorganic substrates. In another aspect, it relates to a method for overcoating such primed substrates with a protective organic layer and to the layered structure resulting therefrom. In a further aspect, it relates to articles primed and overcoated with the compositions of the present invention.

BACKGROUND ART

Primers, which are compositions that promote the adhesion of overcoatings onto substrates, are known in the art. They are particularly useful in articles requiring that organic materials be bonded onto inorganic substrates The strength of the interfacial bond formed in such constructions often determines the ultimate strength and utility of the articles.

Previous attempts have been made to overcoat aluminum and other metals with various substances, but the resulting adhesion of the overcoating is frequently less than is necessary for the desired use. U.S. Pat. No. 3,321,350 teaches that adhesion of a cured polysiloxane onto a solid material, e.g., aluminum, is improved if a primer containing an organosilane and a hydrolyzable titanium compound, some of which primers are within the scope of the primer compositions of the present invention, is first applied. It is taught in U.S. Pat. No. 3,794,556, that a primer composition comprising a mixture of a tetraalkoxysilane, or a partial hydrolyzate thereof, and a tetraalkyl titanate can be used to improve the adhesion of silicone elastomers to titanium metal and to polymerized substrates, such as cured epoxy surfaces and polyurethanes. However, it is not taught in the prior art how to adhere a coating that is polymerized in situ on aluminum or other inorganic substrates with a superior level of adhesion needed in certain applications

Titanium compounds have been used in preparing durable coatings. U.S Pat. No. 2,721,855 teaches that polymeric organosilicone compositions containing titanic acid esters adhere onto various substrates, such as electrical insulators. U.S. Pat. No. 3,779,991 discloses the incorporation of tetraalkyl titanates into polymeric materials having silicon and hydantoin moieties in the polymeric backbone, and the subsequent use of such materials as coatings for wire. A composition and method for enhancing bonding and protection of aluminum surfaces is disclosed in U.S. Pat. No. 3,687,882, wherein the adherent coating is derived from a cohydrolyzed composition of a diaminosubstituted silane and a titanate Galvanic protection to metal surfaces coated with compositions containing hydrolyzed and condensed organosilanes with hydrolyzable titanate esters and zinc particulates is taught in U S. Pat. No. 3,817,905

Compositions comprising silanes and metal esters, some within the scope of the primer compositions of the present invention, have been disclosed in U S. Pat. Nos. 4,042,749, 4,073,967, and 4,084,021 as useful abrasion or corrosion resistant coatings for soft surfaces, including aluminum. These are relatively thick coatings and they are not taught as useful primer compositions.

The prior art, however, does not teach the promotion of adhesion of polymerizable monomeric organic materials, such as epoxy or acrylic monomers, onto primed inorganic surfaces such as aluminum metal, preferably where the primer composition contains acidic material in addition to silanes and metal esters, nor does it teach the curing of monomeric organic coatings by in situ polymerization of the monomers coated onto the primed surfaces.

DISCLOSURE OF INVENTION

Briefly the present invention provides primer compositions for adhering coatings derived from in situ polymerizations of uncured monomers onto inorganic substrates. These primer compositions comprise at least one non-amino- or non-amido-containing silane and at least one of certain metal esters, and also preferably include acidic materials in these primer compositions.

The priming compositions of the present invention provide for the adherence onto inorganic substrates, such as metals, metal oxides, and ceramics, of overcoatings derived from in situ polymerization of monomeric organic compositions that are known in the art to adhere poorly to such substrates. The overcoating compositions which contain, for example, epoxy or vinyl monomers, are cured in situ by heat or radiation.

By "substrate" is meant an underlying support layer which can be the base layer or it can be a thin coating on the base layer.

The primed and overcoated substrates of the present invention provide articles having surfaces that are protected, for example, against weathering, or they may be painted or marked as desired.

DETAILED DESCRIPTION

The present invention provides in one embodiment a primer composition comprising:

a. one part by weight of a non-amino- or non-amido-containing silane of the formula

$$[R^1]_m\text{—Si—}[R^2]_n \qquad (1)$$

in which R^1 is an alkyl or cycloalkyl group that can be unsubstituted or substituted by an ethenyl, methethenyl, acryloxy, methacryloxy, epoxy, mercapto, or an isocyanato group, said substituted group having a total of two to ten carbon atoms and said unsubstituted group having a total of one to ten carbon atoms; R^2 is a hydrolyzable group selected from alkoxy groups having one to eight carbon atoms and acyloxy groups having two to eight carbon atoms; m is an integer from 1 to 3; n is an integer from 1 to 3, with the proviso that $m+n=4$,

b. 1 to 50 parts by weight of metal ester of the formula

$$M[OR^3]_x \qquad (2)$$

in which M is a metal selected from a group consisting of titanium, tantalum, zirconium, aluminum, and antimony; R^3 is an alkyl group having from one to eight carbon atoms, and x is equal to the number of valence bonds of M; and

c an acidic material.

The present invention also provides a layered structure on an inorganic substrate, e.g., metals, such as aluminum, steel or zinc, metal oxides of these metals, and ceramics, such as glass, but preferably on aluminum,

which may be dead-soft (i.e., flexible, easily bent and which retains its shape) or vapor coated on another substrate, which preferably is primed with the above-mentioned acidic material-containing composition, although the above-mentioned primer composition gives satisfactory results with no acidic component present, and overcoated with an organic monomer composition which is subsequently cured. The monomer, which preferably is an epoxy or vinyl monomer or mixtures thereof, is blended with a suitable initiator or a latent polymerization agent. After being applied to the primed substrate, the monomer composition is then cured in situ by heat, radiation, or other appropriate means. The above-mentioned primer, which is heat curable, can be cured simultaneously with the monomer composition if heat is used, or it can be separately cured by heat before application of the monomer layer.

Preparation of the layered structure of the present invention involves two steps.

The first step is the primer preparation and application. This involves the simple mixing or blending at ambient conditions of the following ingredients: a suitable silane, a hydrolyzable metal ester (also called an alkoxide), a suitable solvent, such as ethanol, butanol, 2-ethylhexanol, acetone, or methylethyl ketone, but preferably isopropyl alcohol. Optionally, a minor amount of an acidic material is added. The primer is then applied onto an inorganic substrate such as a metal. It is desirable that the cured primer coating be very thin, i.e., 0.02 to 0.5 microns in thickness. One method of achieving such a thin coating is to use an amount of solvent in the range of 50 to 99 weight percent of the composition, preferably at least 90 weight percent being present.

Typically, after admixing or blending, this primer coating composition is then applied to an inorganic substrate. These primer coatings are preferably used shortly after they are prepared, however, they may be prepared and stored at room temperature or below for several weeks before application.

Non-amino- or non-amido-containing silanes represented by formula (1) above are those wherein R^2 is a hydrolyzable group selected from alkoxy groups having 1 to 8 carbon atoms and acyloxy groups having 2 to 8 carbon atoms and R^1 can be an unsubstituted alkyl or cycloalkyl group, for example, methyltriethoxysilane, octyltriethoxysilane and cyclohexyltrimethoxysilane (all available from Petrarch Systems Inc., Levittown, Pa.). Examples where R^1 contains ethenyl and methethenyl functionality are vinyltriacetoxysilane (Union Carbide Corp.), methylvinyldiethoxysilane (Petrarch Systems, Inc.), divinyldiethoxysilane (Petrarch Systems, Inc.), and gamma-methacryloxypropyltrimethoxysilane (Union Carbide Corp.). Examples where R^1 is a substituted epoxy, mercapto or isocyanato group are gamma-glycidoxypropyltrimethoxysilane (Union Carbide Corp.), beta-(3,4-epoxycyclohexyl)ethyltrimethoxysilane (Union Carbide Corp.), gamma-mercaptopropyltrimethoxysilane (Union Carbide Corp.), and gamma-isocyanatopropyltriethoxysilane (Petrarch Systems, Inc.). These silanes and some of the other useful silanes as known in the art, are given in Table IV. The silanes may be utilized alone or as a mixture of silanes in the practice of the present invention. Gamma-methacryloxypropyltrimethoxysilane is the preferred reactive silane.

Metal esters which have been found useful in the practice of the present invention may be represented by the formula $M[OR^3]_x$, where M is a metal selected from the group consisting of titanium, tantalum, antimony, aluminum, and zirconium, and R^3 is selected from the group consisting of lower alkyl groups containing from 1 to 8 carbon atoms which are bonded to the oxygen atom, and x is equal to the number of valence bonds of M.

Representative metal esters (some of which are shown in Table V, below) which have been found useful in the practice of the present invention include tetraisopropyl titanate (E. I. duPont de Nemours & Co., Inc.), tetrabutyl titanate (duPont), tetraethyl titanate (Alfa Products, Thiokol/Ventron Div., Danvers, Mass.), tetra-2-ethylhexyl titanate (duPont), and pentaethyl tantalate, aluminum isopropoxide, aluminum-s-butoxide, and tetra-n-propyl zirconate, (all available from Alfa Products). Each of the metal esters may be utilized by itself, or in a mixture of metal esters, in the practice of the present invention. Other useful metal esters of the type described are known to the art. The preferred metal ester is tetraisopropyl titanate.

It has been found that the molar ratio of metal ester to silane can vary. For example, in the primer compositions containing tetraisopropyl titanate (TPT) and gamma-methacryloxypropyltrimethoxysilane (GMPS), the useful, preferred, and most preferred ratios are summarized in Table I.

TABLE I

Utility of TPT and GMPS Reactive Silane Primer Compositions on Aluminum

	Ratio of TPT to GMPS	
Range of Utility	weight	mole*
Useful	1.1-50.1	0 87 1-44 1
Preferred	1 1-20 1	0 87 1-18 1
Most Preferred	3 1-10.1	2 6:1-9:1

*molec wt TPT = 284 26, molec wt GMPS - 248 20

Energy is usually required to cure the primer coatings of the present invention. The preferred method of curing primer coatings of the present invention is exposure to heat.

While it is not necessary to incorporate an acidic material in the primer composition, it is desirable to do so. Acidic materials which can be added to the primer composition are such inorganic acids as nitric acid and sulfuric acid and such organic acidic materials as acetic acid, bis(perfluoromethylsulfonyl)methane (see U.S. Pat. No. 2,732,398), higher homologs of fluorinated sulfonylmethanes (see U.S. Pat. No. 3,281,472), and bis(perfluoromethylsulfonyl)phenylmethane (see U.S. Pat. No. 3,632,843). These acidic materials can be present in various concentration levels. The ratio of moles of inorganic acid to the sum of the mole quantities of titanate plus silane is 0:1 to 10:1, and preferably 0.5:1 to 4:1, and for the organic acidic materials the mole ratios are 0.1 to 20:1, and preferably 0.5:1 to 8:1. Priming effects can be achieved without acidic materials in the composition, but incorporation of acid makes a priming composition less subject to attack by moisture and allows for greater variability in the thickness of the primer layer.

The primer coating compositions used in this invention can be applied to a variety of inorganic substrates, such as steel, zinc, ceramics, but preferably the substrate is aluminum. Studies of metals used as substrates for the primer coatings are summarized in Table VI, below. The metal surfaces were first cleaned in a variety of

ways (see Table VI), before the primer coatings were applied, to remove surface contamination. For example, aluminum was precleaned by 1.5 minute immersion in hot (60°-70° C.) aqueous 2.5% Oakite® 166 solution (Oakite Products, Berkeley Heights, N.J.) followed by distilled water rinse, and air drying. The primer layer may be coated on a substrate by usual methods known in the art, e.g., bar, knife, reverse roll, knurled roll, or spin coating, or by dipping, spraying, or brushing. The cured primer coating is very thin, i.e., 0.02 to 0.5 microns in thickness.

The second step is the organic overcoating preparation which involves the simple mixing or blending of the ingredients of a suitable organic monomer with an initiator or a latent polymerization agent. Other additives such as leveling agents, diluents, colorants, fillers, viscosity modifiers, etc. may be added to the above formulation by simple mixing.

The method of preparation of the monomer overcoating composition involves the mixture of a suitable organic monomer, diluted or undiluted, a suitable solvent, such as acetone, fillers, colorants, additives, polymerization agents, initiators, and the like. Preferably, the latent polymerization agent or initiator is added last.

After blending, the overcoating composition is applied to the primer coating layer previously coated onto a suitable inorganic substrate, for example, aluminum. Preferably these overcoatings are used shortly after preparation, however, they may be stored if properly protected from heat and light for several months before application. More than one overcoating layer may be applied to the primed substrates. A variety of thicknesses for the overcoating layers is possible; the ultimate thickness allowable is determined by the properties of the cured overcoatings.

Monomers for overcoatings which have been found useful in the practice of this invention include epoxy resins such as bis(3,4-epoxycyclohexylmethyl) adipate (Union Carbide), and vinyl monomers such as trimethylolpropane triacrylate, hexanediol diacrylate, and pentaerythritol tetraacrylate (all are available from Sartomer Co.). Other vinyl monomers for overcoatings are 1,3-bis[3-(2,2,2-(triacryloxymethyl)ethoxy-2-hydroxypropyl]-5,5-dimethyl-2,4-imidazolidinedione and 1,3-bis[3-(2-acryloxyethoxy)-2-hydroxypropyl]-5,5-dimethyl-2,4-imidazolidinedione, (as disclosed in assignee's copending patent applications, U.S. Ser. No. 051,876 and U.S. Ser. No. 051,877, both filed on June 25, 1979). These monomers are film-forming monomers or prepolymers with a molecular weight up to 5,000, preferably up to 2,000, per polymerizable group.

Leveling agents are also useful in the overcoating composition in the practice of the invention in that they improve coating uniformity. Leveling agents which have been found useful in the practice of the present invention include fluorocarbon-based surfactants, "FC-430" and "FC-431" (3M). These agents are used in minor amounts, i.e., about 0.01% up to about 1% by weight.

Various methods may be employed to cure the overcoatings of the present invention. Epoxy monomers, such as bis(3,4-epoxycyclohexylmethyl) adipate can be cured, for example, with a photoactivatable epoxy cure initiator. Such photoactivatable epoxy cure initiators are generally known in the art and are described in a number of U.S. Pat. Nos. 4,219,377, 4,101,513, and 4,039,521. Triarylsulfoniumhexafluoroantimonate, disclosed in U.S. Pat. No. 4,173,476, is a particularly preferred photoactivatable epoxy cure initiator for use in the present invention, and it is usually present in an amount up to 2% by weight of the epoxy resin.

Vinyl monomer-containing overcoatings, typically with an appropriate latent polymerization agent present in the overcoating blend, can be cured by exposure to ultraviolet light or heat. Latent polymerization agents need not be present to effect curing of vinyl monomer-containing overcoatings via electron beam radiation. Free radical curing of vinyl monomers such as acrylates and methacrylates via ultraviolet light generally requires the presence of latent polymerization agents known as photoinitiators. One class of photoinitiators is acetophenone derivatives such as 2,2-dimethoxy-2-phenylacetophenone (Ciba-Geigy), and 2-hydroxy-2-methyl(3',4'-dimethyl)propiophenone (E. Merck) and are usually present in the overcoating in minor amounts. Other acetophenone derivatives are known in the art (see U.S. Pat. No. 3,715,293), e.g., 2-2-dimethoxyacetophenone, 2,2-diethoxyacetophenone, 2,2-dibutoxyacetophenone, 2,2-dihexoxyacetophenone, 2,2-diphenoxyacetophenone, 2,2-diphenoxy-2-ethylacetophenone, 2,2-diphenoxy-2-cyclopentylacetophenone.

Vinyl overcoating compositions containing free radical photoinitiators will cure when exposed to ultraviolet light. However, it is preferable that curing be conducted in an inert atmosphere such as nitrogen since oxygen inhibits the reaction. Monomeric overcoatings whose cure can be photoinitiated in the absence or presence of oxygen are those containing 1,3-bis[3-(2,2,2-(triacryloxymethyl)ethoxy-2-hydroxypropyl)]-5,5-dimethyl-2,4-imidazolidinedione and 1,3-bis[3-(2-acryloxyethoxy)-2-hydroxypropyl]-5,5-dimethyl-2,4-imidazolidinedione, mentioned above.

Any suitable source which emits ultraviolet light may be used to activate the photoinitiators in the practice of this invention. Suitable sources are mercury arcs, carbon arcs, low-, medium- and high-pressure mercury lamps, plasma arcs, ultraviolet light emitting diodes, and ultraviolet emitting lasers.

Ultraviolet light activation of the latent curing agents used in the overcoatings of this invention can be brought about with the use of such commercially available ultraviolet light sources as the UVEXS model LCU 750 (UVEXS, Inc., Sunnyvale, Calif.) and the RPC model QC 1202 ANIR (RPC Equipment, Plainfield, Ill.). Typical cure conditions with such ultraviolet light sources involve the conveying, or repeated conveying, of an overcoated substrate several centimeters from the source of a 200 watt per 2.54 cm medium pressure mercury lamp, at a suitable conveyor speed, for example, 15 meters/minute.

The overcoatings of the present invention, of which there may be one or more on the primed substrate, may be applied by methods known in the art, such as bar, knife, reverse roll, knurled roll, or spin coating, or by dipping, spraying, or brushing.

The evaluation of adhesion of the overcoating onto a primed inorganic substrate such as aluminum and other metals was conducted using two test methods, both of which were modeled after ASTM tests.

In the first test modeled after ASTM D3359 test method B, "Standard Methods for Measuring Adhesion by Tape Test," strips of Scotch® Brand No. 250 Masking Tape or Scotch® Brand No 810 Magic Mending Tape (3M) were applied to a cross-cut section previously made in the overcoated substrate and the tape was

then removed. The percent adhesion, that is, the amount (area) of coating remaining on the substrate was assessed on a 0–100 scale (see U.S. Pat. No. 4,042,749, col. 8, lines 23–40).

In a second test, modeled after ASTM D2197 test method B, "Standard Test Methods for Adhesion of Organic Coatings," using the parallel groove adhesion test, a point force of approximately 130 grams at the tip of a fixed carbide scribe was applied to a suitably coated substrate. The substrate was then moved beneath the scribe to produce a lined pattern through the coating. Adhesion was evaluated in terms of the closeness with which parallel scribed grooves could be cut through the coating before the film flakes or chips from the substrate. The better the adhesion, the closer together the grooves were cut before film failure (flaking or chipping) occurred.

The layered structures of the present invention find utility in articles that require adherent protective overcoatings, such as automotive trim, window frames, fireplace brick, or metal based tapes, and as pavement marking tapes wherein the overcoating layer has a top surface in which glass retroreflective microspheres and skid-resistant particles may be partially embedded in the surface. Other applications include applications which require decorative overcoatings.

The present invention will be more readily understood from a consideration of the following examples which are meant to illustrate, but not limit this invention. Parts and percentages are by weight unless otherwise indicated and temperatures are in degrees centigrade. In the following examples, primer coatings were applied to substrates using an RDS bar coater No. 3 and overcoatings were applied to primed surfaces using an RDS bar coater No. 14 (both coaters are available from R. D. Specialties Inc., Webster, N.Y.) unless indicated otherwise. Percent adhesion was measured using as a model ASTM D3359 test method B, unless indicated otherwise. In the examples using acids, i.e., conc. nitric acid (70%), acetic acid (glacial), conc. sulfuric acid (96%), each drop of acid contains 0.02 to 0.04 g acid.

EXAMPLES 1–12

The following is a model procedure for Examples 1–12. The results are summarized in Table II.

A primer composition was prepared by adding two drops of concentrated nitric acid to a solution of 19.6 g of isopropyl alcohol containing 0.4 g of gamma-methacryloxypropyltrimethoxysilane (GMPS) with 0.04 g of tetraisopropyl titanate (TPT). The resulting primer solution was coated onto a sample of #3003 aluminum alloy [precleaned by 1.5 minute immersion in hot (60°–70° C.) aqueous 2.5% Oakite 166 solution followed by distilled water rinse, then air dried]. The primer coating was cured for five minutes at 120° C. The primed aluminum was then overcoated with overcoating formulation A prepared by mixing 60 parts of 1,3-bis[3-(2,2,2-(triacryloxymethyl)ethoxy-2-hydroxypropyl)]-5,5-dimethyl-2,4-imidazolidinedione to 40 parts of 1,3-bis[3-(2-acryloxyethoxy)-2-hydroxypropyl]-5,5-dimethyl-2,4-imidazolidinedione to 2 parts of 2,2-dimethoxy-2-phenylacetophenone (Ciba-Geigy Corp., Ardsley, N.Y.) to 0.1 part of FC-430 to 100 parts acetone. This overcoating was cured photochemically by exposure of the overcoated substrate to ultraviolet light. The ultraviolet light source was a model LCU 750 200 watt/2.54 cm medium pressure mercury lamp (UVEXS, Sunnyvale, CA) which emitted short wavelength (200–320 nm) and long wavelength (320–430 nm) ultraviolet light. The coated substrate was placed on a conveyor and was passed under this ultraviolet light source three to four times at a conveyor speed of 15.2 meters per minute and at a distance of about 15 cm from this source.

The cured overcoating was then tested for adhesion using the ASTM D3359 test (cross hatch/tape pull test) using Scotch Brand No. 250 Masking Tape. The results using various ratios of GMPS to TPT for Examples 1–12 are given in Table II, and the range of utility was summarized in Table I, above.

TABLE II

Adhesion of Overcoating A onto Primed Aluminum

Ex. No.[a]	Isopropyl Alcohol (g)	TPT (g)	GMPS (g)	Ti:Si Ratio (wt/wt)	Nitric Acid (Concentrated) (drops)	% Adhesion Run No. 1	% Adhesion Run No. 2
1	19.6	—	0.4	Only Si	2	80	10–70
2	19.6	0.04	0.4	1:10	2	20	60–70
3	19.6	0.06	0.36	1:6	2	20	10–40
4	19.6	0.1	0.3	1:3	2	10	20–40
5	19.6	0.2	0.2	1:1	2	80–85	50–80
6	19.6	0.3	0.1	3:1	2	95–100	100
7	19.6	0.36	0.06	6:1	2	95–100	100
8	19.6	0.4	0.04	10:1	2	95–100	100
9	39.2	0.8	0.04	20:1	4	75–90	95
10	78.4	1.6	0.04	40:1	8	40–70	80–85
11	19.6	0.4	—	Ti Only	2	65–70	40
12	19.6	—	—	—	2	0	0–5

[a] Ex. Nos. 1–4 and 11 and 12 are controls.

The data show that adhesion of overcoating A onto primed aluminum was commercially useful when the weight ratio of TPT to GMPS was 1:1 to 50:1, the preferred ratio being 1:1 to 20:1, and the most preferred ratio being 3:1 to 10:1. These results were presented in TABLE I, above.

EXAMPLES 13–25

The following is a model procedure for Examples 13–25. The results are summarized in Table III.

A primer composition was prepared by adding one drop of concentrated nitric acid to a solution of 9.8 g isopropyl alcohol containing 0.2 g gamma-methacryloxypropyltrimethoxysilane with 0.2 g tetraisopropyl titanate. As in Examples 1–12, this solution was coated onto a sample of cleaned aluminum alloy #3003 (cleaned as indicated in Examples 1–12) and cured for five minutes at 120° C. The primed aluminum was then overcoated with coating formulation B prepared by mixing of 100 parts of 1,3-bis[3-(2,2,2-(triacryloxymethyl)ethoxy-2-hydroxypropyl)]-5,5-dimethyl-2,4-

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imidazolidinedione to 100 parts 2-butanone (methyl ethyl ketone) to 2 parts of 2-hydroxy-2-methyl(3',4'-dimethyl)propionphenone (E. Merck, Darmstadt, Germany) to 0.1 part FC-431 (3M). The cure of this overcoating composition was initiated photochemically, essentially following the procedure of Examples 1-12 wherein the ultraviolet light source was a 300 watt/2.54 cm mercury lamp (Model QC 1202 ANIR, RPC Equipment, Plainfield. Ill.). The coated substrate was placed on a conveyor and was exposed to this ultraviolet light source at a distance of about 15 cm and at a conveyor speed of 24.4 meters per minute.

The cured overcoating was then tested for adhesion using ASTM D3359 test B described above (cross hatch/tape pull test) using No. 810 Scotch Brand Magic Mending Tape. Results for Examples 13-25 are shown in Table III.

TABLE III

Adhesion of Overcoating B onto Primed Aluminum

Ex No (b)	TPT (g)	GMPS (g)	Ti:Si Ratio (wt/wt)	% Adhesion
13	—	0 2	Only Si	0
14	0 002	0.198	1:99	0
15	0 004	0 196	1:49	2
16	0 008	0 192	1:24	2
17	0 02	0.18	1:9	0
18	0 05	0.15	1 3	0
19	0 1	0.1	1:1	100
20	0 15	0.05	3 1	95
21	0 18	0.02	9:1	100
22	0 192	0.008	24 1	50
23	0 196	0.004	49:1	5
24	0 198	0 002	99.1	10
25	0 2	0.0	Ti Only	10

(b) Example Nos 13-18 and 24 and 25 are controls.

The data of TABLE III show results similar to those of TABLE II. Compositions within the invention (i.e., Ex. Nos. 19-23) generally show better adhesion than controls; especially good are those compositions with TPT:GMPS ratios within the preferred range of TABLE I, above.

EXAMPLES 26-45

Examples 26-45 evaluate different silanes used in formulations for primers on aluminum substrates, which were then overcoated with formulations A and B of Examples 1-25. Results are summarized in Table IV using the following procedural model.

A primer composition was prepared by adding one drop of concentrated nitric acid to a solution of 9.8 g isopropyl alcohol containing 0.15 g tetraisopropyl titanate and the corresponding weight of selected silane indicated in Table IV (the number of moles of silane was kept constant within limits of measurements). This composition was coated onto a sample of aluminum alloy #3003 (cleaned as described in Example 1) and then cured at 120° C. for five minutes. In one set of examples, the primed aluminum panel was then overcoated with the overcoating formulation A, and photochemically cured as described in Examples 1-12. Adhesion of the overcoating was evaluated using the ASTM D3359 test method B using Scotch Brand tapes previously mentioned and results of two runs are shown in the Acrylate Formulation columns of Table IV.

In a second set of examples, the primed aluminum panel, primed as described above, was then overcoated with an epoxy formulation in place of the acrylate formulations used in Examples 1-25. The epoxy formulation, which was made by adding 100 parts of epoxy resin, bis(3,4-epoxycyclohexylmethyl) adipate with 2 parts of photoactivatable epxoy cure initiator triarylsulfoniumhexafluoroantimonate (General Electric Co.) and 0 1 part of surfactant FC-430 in 100 parts of acetone, was overcoated onto the primed aluminum. The overcoating was cured via ultraviolet light photoinitiation as described above and adhesion of this epoxy overcoating was evaluated for two runs according to ASTM D3359 test method B using Scotch Brand tapes previously mentioned and summarized in the Epoxy Formulation columns of Table IV.

TABLE IV

Adhesion of Overcoated Primed Aluminum Using Various Silanes

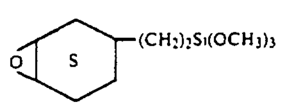
Ex. No (a)	Silane Chemical Structure	wt (g)	% Adhesion: Acrylate Formulation(c) Run 1	Acrylate Formulation(c) Run 2	Epoxy Formulation Run 1	Epoxy Formulation Run 2
26	$CH_2{=}C(CH_3)CO_2(CH_2)_3Si(OCH_3)_3$	0.05	95	90	100	100
27	$CH_3Si(OCH_3)_3$	0.03	15	5	75	20
28	$CH_3Si(OC_2H_5)_3$	0.04	0	0	100	50
29	$(CH_3)_2Si(OC_2H_5)_2$	0.03	15	0	95	20
30	$CH_3CH_2CH_2Si(OCH_3)_3$	0.03	5	5	100	100
31	$CH_3CH_2CH_2Si(OC_2H_5)_3$	0 04	5	0	100	100
32	$CH_2{=}CHSi(O_2CCH_3)_3$	0 05	85	5	95	90
33	$CH_2{=}CHSi(OC_2H_5)_3$	0 04	80	20	100	95
34	$(CH_2{=}CH)CH_3Si(OC_2H_5)_2$	0 03	80	0	100	25
35	$(CH_2{=}CH)_2Si(OC_2H_5)_2$	0 03	90	0	100	20
36	$(CH_2{=}CH)(CH_3)_2SiOC_2H_5)$	0 03	20	5	95	25
37	CH_2—$CHCH_2O(CH_2)_3Si(OCH_3)_3$ (O)	0.05	—	—	50,0-20(f)	—
38		0.05	—	—	0,20-90(f)	—
39	$OCN(CH_2)_3Si(OC_2H_5)_3$	0 05	0	0	60	95
40	$HS(CH_2)_3Si(OCH_3)_3$	0.04	100	20	100	100
41	$CH_2{=}CHCONH(CH_2)_3Si(OC_2H_5)_3$	0.05	5	5	—	—
42	$CH_2{=}C(CH_3)CONH(CH_2)_3Si(OC_2H_5)_3$	0.05	5	5	—	—

TABLE IV-continued

Adhesion of Overcoated Primed Aluminum Using Various Silanes

Ex. No[g]	Silane Chemical Structure	wt. (g)	% Adhesion: Acrylate Formulation[c] Run 1	Acrylate Formulation[c] Run 2	Epoxy Formulation Run 1	Epoxy Formulation Run 2
43	$HO_2CCH{=}CHCONH(CH_2)_3Si(OC_2H_5)_3$	0 07	0	0	—	—
44	$H_2N(CH_2)_3Si(OC_2H_5)_3$	0 04	0	0	0	0
45	$H_2N(CH_2)_2NH(CH_2)_3Si(OCH_3)_3$[d,e]	0 04	0	0	0	0

[c]Run 1 used formulation A (see Ex. 1-12) and Scotch Brand No 250 Masking Tape in all adhesion tests Run 2 used formulation B (see Ex. 13-25) and Scotch Brand No. 810 Magic Mending Tape in all adhesion tests
[d]See U S Pat No 3,687,882
[e]Nitric acid omitted
[f]Replicate runs
[g]Ex Nos 41–45 were controls

The results of TABLE IV show that the control formulations of Examples 41-45, wherein the silanes contain amino or amido groups, do not perform as well as primers within the present invention. The formulation of Ex. No. 26 gave superior results.

EXAMPLES 46-52

Examples 46-52 illustrate some of the metal esters which have been evaluated as a constituent in the primer formulation. Results are given in Table V using the following procedural model.

A primer composition was prepared by adding one drop of concentrated nitric acid to a solution of 9.8 g isopropyl alcohol containing 0.05 g gamma-methacryloxypropyltrimethoxysilane with the corresponding weight of selected metal ester indicated in Table V. The weight of metal ester was selected so that the mole ratio of the ester to silane was in a preferred ratio of about 2 6:1 (see Table I). This composition was coated onto two samples of aluminum alloy #3003 (cleaned as indicated in Examples 1-12) which were then cured at 120° C. for five minutes. One of the primed panels was then overcoated with overcoating formulation A (see Examples 1-12) and one with overcoating formulation B (see Examples 13-25), and both were then photochemically cured as described above.

The effectiveness of the metal ester in the primer composition was then indirectly measured by evaluating the adhesion of the overcoating onto the respective primed aluminum panel. ASTM D3359 test method B used Scotch Brand tapes previously mentioned and the results are provided in Table V.

TABLE V

Adhesion of Overcoated Primed Aluminum Using Various Metal Esters

Ex. No.	Metal Ester Structure	wt (g)	% Adhesion Formulation A	B
46	$Ta(OC_2H_5)_5$	0.21	95–100	100
47	$B(OC_2H_5)_3$[g]	0 08	0–10	0
48	$Sb(n\text{-}OC_4H_9)_3$[h]	0 18	20–80	20
49	$Zr(n\text{-}OC_3H_7)_4$	0 17	0–10	10
50	$Zr(n\text{-}OC_4H_9)_4\ n\text{-}C_4H_9OH$	0 24	10	10
51	$Al(s\text{-}OC_4H_9)_3$	0 17	0–80	2
52	$Ti(i\text{-}OC_3H_7)_4$	0.15	95–100	98

[g]control
[h]nitric acid omitted

The data of TABLE V show a range of priming capabilities observable upon use of different metal esters (alkoxides). Preferred, due to performance, price, and availability is $Ti(i{-}OC_3H_7)_4$.

EXAMPLES 53-57

Various metal substrates for the primer coatings and the organic overcoatings were evaluated and the results are summarized in Table VI. The following is a model for the procedure used.

Each pair of primer solutions in Examples 54-57 was coated onto clean sample panels of copper, steel, and zinc, and cured at 120° C. for five minutes. Primer solutions in corresponding overcoatings as prepared in Examples 1, 4, 6, 11, 13, 18, 20, and 25 refer to Examples 54, 55, 56, and 57 as described in TABLE VI. The adhesion of the overcoatings to the panels was evaluated in accordance with ASTM D3359 test B using Scotch Brand No. 250 Masking Tape for Run 1 and Scotch Brand No 810 Magic Mending Tape for Run 2.

TABLE VI

Adhesion Studies of Overcoated, Primed Metals

Ex No[l]	Primer Solution From Example No Run 1	Primer Solution From Example No Run 2	Aluminum Run 1	Aluminum Run 2	Copper[i] Run 1	Copper[i] Run 2	Steel[j] Run 1	Steel[j] Run 2	Zinc[k] Run 1	Zinc[k] Run 2
53	No primer		0	0–5	0	0	0	0	0	0
54	1	13	80	10–70	0	5	0–5	10	10	0
55	4	18	10	20–40	10	0	0	0	10	0
56	6	20	95–100	100	0	0	95	0	10–20	70
57	11	25	65–70	40	5	0	0	0	0	0

[i]Cleaned using ASTM method B281A 1 5
[j]Cleaned by acetone rinse, then wiped then acetone rinsed, and air dried
[k]Cleaned by 1 min immersion in 0 5% hydrochloric acid followed by distilled water rinse, then air dried
[l]Ex Nos 53, 54, 55, and 57 were controls

Results of TABLE VI show that the formulation of Ex No. 56, within the present invention, gave better to

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superior results to controls on all substrates evaluated, except copper.

EXAMPLES 58-60

The application of three different acrylic monomer based overcoatings onto primed aluminum is illustrated by Examples 58-60 with details and adhesion results reported in Table VII. In each case, the most preferred (i.e., Ti:Si ratio of 3:1) primer composition of Example 20 was coated onto panels of cleaned aluminum alloy #3003 and cured at 120° C. for five minutes. The panel was overcoated (see Table VII) with the respective acrylate formulation which contained one drop of 10% FC 431 surfactant in acetone plus the indicated amount of photoinitiator (i.e., 2-hydroxy-2-methyl(3',4'-dimethyl)propiophenone, HMDP. The overcoating was cured by the photoinitiation technique and adhesion was evaluated according to ASTM D3359 test method B using Scotch Brand No. 810 Magic Mending Tape.

TABLE VII

Adhesion of Acrylates onto Primed Aluminum

Ex No	Monomer	Acetone (g)	Photoinitiator HMDP	RDS Coater Bar No	% Adhesion
58	Trimethylolpropane triacrylate (1.5 g)	0.5	0.03 g	8	100
59	Hexanediol diacrylate (1.0 g)	—	0 02 g	3	95
60	Pentaerythritol tetraacrylate (1 0 g)	1.0	0 02 g	14	100

The results of TABLE VII show that all three cured monomer coatings adhered very well to the primed aluminum.

EXAMPLES 61-76

The percent adhesion of primed, overcoated aluminum wherein no acidic material was incorporated into the primer formulation is shown in the data of Examples 61-64 of Table VIII, while the percent adhesion using various acidic materials incorporated into the primer formulation is given in the data of Examples 65-76 of Table VIII. Two curing temperatures (90° C. and 150° C.) and two curing times (5 minutes and 10 minutes) are reported. The following procedure was the model for the examples in Table VIII.

A primer coating composition, prepared by adding 0.03 g of acidic material to a solution of 9.8 g of isopropyl alcohol containing 0.1 g of tetrapropyl titanate with 0.1 g of gamma-methacryloxypropyltrimethoxysilane was coated onto aluminum as described in Example 1 and cured at 90° C. for five minutes. The primed panel was then overcoated with the overcoating formulation A (see Example 1) and photochemically cured as described in Example 1. Adhesion was evaluated according to model ASTM D3359 test method B using Scotch Brand No. 810 Magic Mending Tape. Results are shown in Table VIII

TABLE VIII

Adhesion of Overcoated Primed Aluminum Using Acidic Materials

Ex No	Acidic Material	Primer Cure Conditions Temp (°C)	Time (min)	% Adhesion
61	None	90	5	20
62	"	90	10	0
63		150	5	80
64		150	10	0
65	Nitric acid	90	5	20

TABLE VIII-continued

Adhesion of Overcoated Primed Aluminum Using Acidic Materials

Ex. No.	Acidic Material	Primer Cure Conditions Temp. (°C.)	Time (min.)	% Adhesion
66	"	90	10	100
67	"	150	5	95
68	"	150	10	100
69	Sulfuric acid	90	5	95
70	"	90	10	100
71	"	150	5	100
72	"	150	10	100
73	PDS[m]	90	5	15
74	"	90	10	100
75	"	150	5	95
76	"	150	10	100

[m]PDS = bis(perfluoromethylsulfonyl)phenylmethane (see U.S. Pat. No. 3,632,843)

The data of TABLE VIII show that acidic material is not required in the primer compositions of the present invention; however, it is preferred and more consistent results are obtainable when acid is used.

EXAMPLES 77-87

The percent adhesion of unprimed and primed overcoated aluminum wherein different concentrations of nitric acid and acetic acid were used in the primer formulation is summarized in TABLE IX. The following procedure is a model for Examples 77-87.

A primer coating composition, prepared by adding the specified amount of acid, as indicated in the corresponding example of TABLE IX, to a solution of 9.8 g of isopropyl alcohol containing 0 15 g of tetraisopropyl titanate with 0.05 g gamma-methacryloxypropyltrimethoxysilane, was coated onto cleaned aluminum as described in Examples 13-25 and cured at 120° C. for five minutes. The primed panel was then overcoated with overcoating formulation B and photochemically cured as described in Examples 13-25. Adhesion was evaluated according to model ASTM D3359 test method B using Scotch Brand No. 810 Magic Mending Tape. The results are summarized in TABLE IX.

TABLE IX

Use of Varying Concentrations of Acid in Adhesion of Overcoated, Primed Aluminum

Ex No	Acid	Acid Wt (g)	Ratio of moles acid to moles (titanate + silane)	% Adhesion
77[a]	—	—	—	0
78	—	—	—	95
79	Nitric	0 06	0 9	100
80	Nitric	0 12	1.8	100
81	Nitric	0 24	3 6	100
82	Nitric	0 48	7.3	80
83	Acetic	0 06	1 4	95
84	Acetic	0 12	2 7	75
85	Acetic	0 24	5 5	80
86	Acetic	0 48	11 0	100
87	Acetic	0.96	22 0	50

[a]no primer used (control)

The results of TABLE IX show that, within limits, varying the amount of acidic material in the primer composition does not deleteriously affect adhesion. It was useful to have a ratio of moles of inorganic acid to the sum of mole quantities of titanate plus silane that were 0:1 to 10:1, preferably 0.5:1 to 4:1, and for the organic acidic materials, the useful mole ratios were 0:1 to 20:1, and preferably 0 5:1 to 8:1

EXAMPLE 88

Modified ASTM D 2197 Test Method B mentioned above was used in this example. Primed (as in Example 6) and non-primed aluminum panels were overcoated with formulation A (see Examples 1-12) modified to include about 0.05% of Brillant Yellow fluorescent indicator (Aldrich Chemical Co., Milwaukee, WI) for visual purposes. Each panel was placed under the tip of a carbide scribe to which a force of about 130 g was applied. Each panel was then mechanically moved beneath this scribe to provide a line through the overcoating. A second line, parallel to and 0.25 mm away from the first line, was similarly scribed. The overcoating between these two scribed lines remained intact on the primed panel but flaked off from the non-primed panel, indicating a failure of the overcoating to adhere to the non-primed substrate.

Various modifications and alterations of this invention will become apparent to those skilled in the art without departing from the scope and spirit of this invention, and it should be understood that this invention is not to be unduly limited to the illustrative embodiments set forth herein.

We claim:

1. A method for preparing a layered structure comprising the steps of:

a. providing a substrate selected from a metal, metal oxide, or ceramic,

b. coating at least one surface of said substrate with a primer composition comprising:

(1) one part by weight of a non-amino- or non-amido-containing silane of the formula

$$[R^1]_m—Si—[R^2]_n \qquad (1)$$

in which R^1 is an alkyl or cycloalkyl group that can be unsubstituted or substituted by an ethenyl, methethenyl, acryloxy, methacryloxy, epoxy, mercapto, or an isocyanato group, said substituted group having a total of two to ten carbon atoms and said unsubstituted group having a total of one to eight carbon atoms; R^2 is a hydrolyzable group selected from alkoxy groups having one to eight carbon atoms and acyloxy groups having two to eight carbon atoms; m is an integer from 1 to 3; n is an integer from 1 to 3, with the proviso that $m+n=4$;

(2) 1 to 50 parts by weight of metal ester of the formula

$$M[OR^3]_x \qquad (2)$$

in which M is a metal selected from a group comprising titanium, tantalum, zirconium, aluminum, and antimonyl; R^3 is an alkyl group having from one to eight carbon atoms; and x is equal to the number of valence bonds of M;

(3) 0.5:1 to 4.1 moles by weight of an inorganic acidic material, or 0.5:1 to 8:1 moles by weight of an organic acidic material, compared to the total moles by weight of metal ester plus silane; and

(4) an amount of solvent consisting essentially of organic solvent sufficient to provide for blending of the components of said primer composition;

c. overcoating said primer composition with at least one layer of an uncured organic monomer composition, said monomer selected from epoxy and vinyl monomers, and

d. curing said organic composition.

2. The method according to claim 1 wherein said primer composition is cured previous to or at the time of curing of said monomer composition.

3. The method according to claim 1 wherein said solvent in the primer composition is selected from isopropyl alcohol, ethanol, butanol, 2-ethylhexanol, acetone, and methyl ethyl ketone.

* * * * *

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United States Patent [19]

Makosch

[11] **4,397,237**

[45] **Aug. 9, 1983**

[54] **ROLLER TRAIN STRUCTURE FOR USE WITH PRINTING MACHINE**

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[73] Assignee: **M.A.N.-Roland Druckmaschinen Aktiengesellschaft**, Augsburg, Fed. Rep. of Germany

[21] Appl. No.: **353,608**

[22] Filed: **Mar. 1, 1982**

[30] **Foreign Application Priority Data**

Mar. 31, 1981 [DE] Fed. Rep. of Germany 3112745

[51] **Int. Cl.**[3] **B41F 31/32**

[52] **U.S. Cl.** **101/352**; 101/247; 118/262

[58] **Field of Search** 101/352, 349, 351, 350, 101/209, 247, 148, 139, 140, 143, 144, 145, 182, 184, 185; 118/262

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Primary Examiner—Edgar S. Burr
Assistant Examiner—Moshe I. Cohen
Attorney, Agent, or Firm—Frishauf, Holtz, Goodman & Woodward

[57] **ABSTRACT**

To provide access to an ink application roller (11) located circumferentially about the plate cylinder (1) and behind another ink application roller (10), the inner one (11) of the ink application rollers is secured to an inner support plate (14) which is pivotable together with an outer support plate (13) about a bushing of a bearing (21) retaining a milling roller of the ink train, the outer plate additionally supporting other ink distribution rollers (7, 8) receiving ink from an ink supply roller (3), so that the entire roller train (B) formed by the ink distribution rollers (7, 8) and the inner one (11) of the ink application rollers can be tipped out of engagement position to thereby provide access to those rollers which are located behind the milling roller (9). The system is particularly applicable for a double-parallel ink train arrangement in which the respective ink distribution rollers and application rollers are physically located behind another ink train (A) formed by another roller system (4, 5, 6).

5 Claims, 2 Drawing Figures

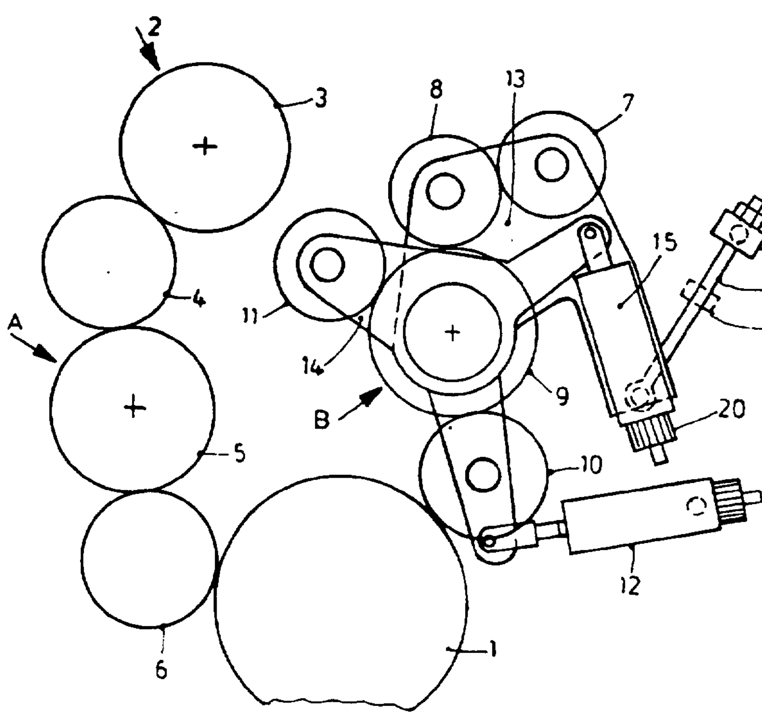

Fig.1

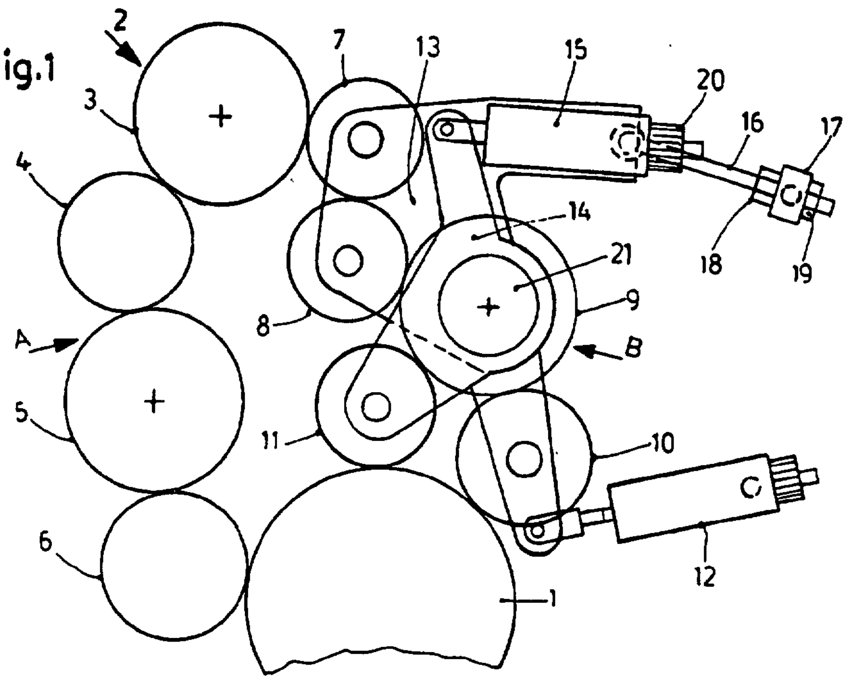
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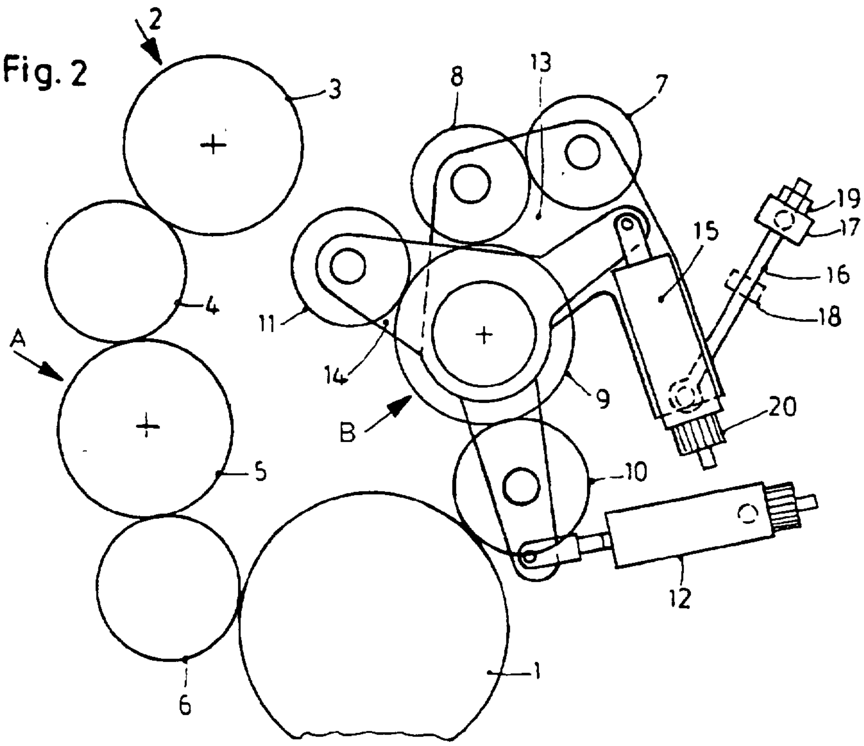
Fig. 2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ROLLER TRAIN STRUCTURE FOR USE WITH PRINTING MACHINE

The present invention relates to a roller train structure which can be applied against a plate cylinder of an offset printing machine or a raised-letter press printing machine, and more particularly to a holder structure suitable for an ink roller train.

BACKGROUND

Roller trains, particularly to distribute ink in the inking system of a printing machine, frequently use a plurality of rollers which are so arranged that some rollers hide other rollers therebeneath, so that access to the inner ones of the rollers is impaired. In some structures, it is desirable to permit movement of rollers towards or away from another engaged roller. British Pat. No. 1,422,421 describes an inking system in which a plate cylinder is inked by a plurality of ink application rollers. The ink application rollers, in turn, receive ink over two roller trains. To permit change-over, or to engage and disengage the inking system, one further roller can be pivoted or tipped about a roller which is journaled in fixed bearings, maintained in a predetermined position in the frame. Such roller trains have disadvantages in that it is difficult to replace certain rollers without disassembling the entire roller train, and particularly without disassembling the rollers which hide the inner ones, or the ones covered thereby. Thus, maintenance and/or exchange of some of the rollers beneath outer ones is difficult, time-consuming, and expensive.

THE INVENTION

It is an object to provide a roller train which permits disassembly or adjustment of any one of the rollers thereof, even though the particular roller may be hidden beneath or behind another one, and without disassembling the outer or covering roller, or roller set or group.

Briefly, a first bearing plate is provided, secured to an outer roller which is maintained in position. The first bearing plate can be pivoted or tilted or rocked about the axis of rotation of this outer roller. At least one roller is retained in the first bearing plate, and in surface engagement with the outermost roller. The bearing plate, further, retains a second bearing plate thereon, which is relatively rotatable with respect to the first one, the second bearing plate supporting at least one inner roller. Positioning control elements are provided secured to the first bearing plate and defining the position of the second bearing plate, and the relative position of the roller or rollers secured thereto. The first bearing plate also has positioning elements associated therewith, permitting rocking or pivoting of the first bearing plate about the axis of rotation of the outermost roller to such an extent that, thereby, the inner rollers which are secured to the second bearing plate become accessible.

The roller train has the advantage that those rollers which, in normal operation, are not readily accessible still can be removed or reached without substantial disassembly time, since it is no longer necessary to disassemble the outer rollers in order to reach, for example, an inner one for replacement because of wear, or for maintenance, or for adjustment. Further, the system is particularly simple to service and to adjust since the

inner rollers can be relatively adjusted in their position without requiring disassembly of the outer rollers.

The system can be used in inking systems both for offset as well as for raised-letter presses which have dual or multiple path ink trains. The system further has the advantage that the pivoting arrangement can be easily adjusted by pivoting against a stop so that the positioning of the rollers, after service work, for example on the inner rollers, and after re-positioning, will be retained as controlled, without renewed re-adjustment of the position of outer rollers, which have been tipped or pivoted out of their normal position. Placement of the outer rollers with respect to other rollers or cylinders of the system which have bearings fixed in a frame thus is simple.

DRAWINGS

FIG. 1 is a schematic side view of a portion of the roller train of an inking system, illustrating those parts which are close to the plate cylinder of a rotary offset printing machine, with the rollers in engaged position; and

FIG. 2 illustrates the system of FIG. 1 with the rollers in disengaged or removed position.

The inking system 2 supplies ink to a plate cylinder 1 by applying ink from an ink trough (not shown) and, for example, a ductor roller which supplies the ink necessary for inking of the plate cylinder. Ductor or film-forming or milling rollers may be used in accordance with any known and suitable structure. The ink supply system itself is generally known, and thus not shown in FIGS. 1 and 2. The ink derived from the ink trough is applied to an ink roller 3 and then applied over distribution rollers 4 and 5 to an application roller 6 which provides ink for the plate cylinder 1. This ink train is labeled ink train A. As shown, the ink train is in continuous rolling engagement with the plate cylinder 1.

A parallel ink train B is in rolling contact with the ink roller 3. Ink roller 3 may be a milling roller, and ink is applied to further ink rollers 7 and 8, and from there on a milling roller 9. Two secondary application rollers 10, 11 are in engagement with the milling roller 9 which, together with the application roller 6, provides for uniform inking of the plate cylinder 1.

The secondary ink application roller 11 is positioned inwardly of the rollers 7, 8, 9 and 10, and is therefore hidden behind the rollers. Roller 11 may be termed an inner roller, and access thereto is impeded by the other rollers as well as by the milling roller 9. Thus, the secondary roller 11 cannot be serviced or exchanged or adjusted without removing the outer rollers 8, 9, 10 and, preferably, also roller 7, which together impede access to the roller 11. Roller 10, of course, can readily be exchanged and serviced, and its adjustment position easily controlled by an adjustment element 12, for example a pneumatic or hydraulic cylinder-piston arrangement, which permits engagement and disengagement of the cylinder 10 with the surface of the plate cylinder 1.

In accordance with the invention, the milling roller 9 is secured in bearings 21 in the side walls of the machine (not shown), and thus fixed in position. A first, or outer plate 13 is provided, rotatable or pivotable about the bearing bushings of the milling roller 9. The outer, or first bearing plate 13 is used to receive the bearings of the rollers 7 and 8. Additionally, plate 13 supports a second, or inner bearing plate 14. The second or inner bearing plate 14 is rotatable relative to the outer or first

plate 13 about the axis of rotation of the milling roller 9, for example about the outer bearing bushing thereof.

A similar arrangement, the mirror image of that described, is located at the other axial ends of the rollers. The bearing plate 14, located at the end faces of the milling roller 9 receive the bearings for the secondary ink application roller 11. To properly position the secondary ink application roller 11 in the desired location on the plate cylinder, bearing plate 13 has a positioning element 15 associated therewith, for example a hydraulic or pneumatic piston-cylinder positioning element secured on plate 13, which permits lifting the bearing plate 14 and with it the secondary application roller 11 off the plate cylinder 1 or, alternatively, in engagement therewith; positioned movement of the positioning element 15 coupled to the inner bearing plate 14 is independent of rocking or pivoting movement of the outer bearing plate 13 which carries element 15.

The bearing plate 13 can be pivoted together with the bearing plate 14 by a further positioning element formed by components 16, 17, 18, 19 to pivot the outer bearing plate 13 in clockwise direction about the milling roller 9 so that, in a limiting position, the bearing roller 11, and its adjustment position, is readily accessible—see FIG. 2. This permits, for example, removal of servicing of the roller 11 without the necessity of disassembly of any one of the other rollers of the system.

The locating arrangement for the outer, or first plate 13 includes a guide rod 16 which is pivotably linked to the bearing plate 13 with one end thereof. The other end of the guide rod 16 is threaded and is guided in a rotatable holder 17 which is fixed in position, for example on the frame (not shown) of the machine. Adjustment or positioning nuts 18, 19 are threaded on the guide rod 16 at both sides of the holder 17 so that the position of the guide rod 16 can be predetermined.

Operation: To carry out maintenance work, nut 19 is loosened and, upon rotation of holder 17, the first or outer plate 13, and with it the inner plate 14, is rocked from the position shown in FIG. 1 to the position shown in FIG. 2, where the secondary ink application roller 11 is readily accessible. After carrying out the necessary maintenance work on the secondary ink application roller 11, for example exchange, finishing of the surface thereof, or the like, and while the roller train is in the position of FIG. 2, the position of the adjustment nut 19 is re-established. This insures that the roller 7 will, upon change-over to the position of FIG. 1, have the same distance or engagement pressure with respect to roller 3 which it had prior to pivoting the entire system from the position of FIG. 1 to the position of FIG. 2.

Individual fine adjustment of the ink application roller 11 is carried out by an adjustment button 20, associated with the, preferably pneumatic, lifting or disengagement device 15. As can be seen in FIGS. 1 and 2, the position of the secondary ink application roller 11 with respect to the plate cylinder, once determined by the adjustment knob 20, is not changed when the plates are pivoted about the bearing 21 of the milling roller 9. This substantially simplifies adjustment of the secondary ink application roller 11, and hence results in substantial saving of time. Further, adjustment or maintenance work on the roller 8 of the roller train B is simplified since this roller also becomes freely accessible when the roller train is pivoted or tipped into the position shown in FIG. 2. Roller 8, likewise, can be readily exchanged or its radial position adjusted, as well known, for example by an eccentrically located bearing or the like.

Roller train A has been shown in its simplest standard form; it, of course, can also be constructed similarly to the roller train B, with dual support plates, merely in form of a right-for-left reversed mirror image.

Various changes and modifications may be made within the scope of the inventive concept.

I claim:

1. In combination with a printing machine having a plate cylinder (1),

an ink train system having

an ink distribution roller means (7, 8);

two application rollers (10, 11) positioned in circumferentially offset location about the circumference of the plate cylinder, whereby one roller (11) will be located behind the other roller and thereby form an inner roller (11) of the ink train system;

an ink transfer roller (9) in engagement with both said application rollers (10, 11), and further in engagement with the ink distribution roller means (7, 8);

and bearing means (21) locating the ink transfer roller in a fixed position on a frame of the machine,

comprising,

a first outer support plate (13) pivotally mounted to pivot about the axis of rotation of said bearing means (21), said first outer support plate securing thereon the ink distribution roller means (7, 8);

a second, inner support plate (14) pivotally mounted to pivot about the axis of rotation of said bearing means independently of pivoting movement of said outer support plate, said second, inner support plate securing thereon the inner roller (11);

first operating means (16–19) coupled to the first outer support plate (13) to effect and control pivoting movement thereof about the axis of rotation of the transfer roller (9);

and means to render the inner application roller (11) accessible from behind the outer application roller (10) including second operating means (15, 20) coupled to the second, inner support plate (14) and secured to the first outer support plate (13) to control relative positioning of the inner roller (11) with respect to the plate cylinder (1) while permitting rolling movement about the circumference of the transfer roller (9) upon pivoting or tipping the first, outer plate (13) about the axis of rotation of the transfer roller under command of said first operating means.

2. System according to claim 1, wherein said ink train system further includes an ink supply roller (3) and roller elements (4, 5, 6) applying ink from the ink supply roller (3) to the plate cylinder;

and wherein said ink distribution roller means (7, 8) comprises an ink distribution roller (7) in engagement with said distribution roller (3) when said outer plate (13) is pivoted for engagement position of the respective ink distribution roller (7) and said ink supply roller (3) with each other.

3. System according to claim 2 wherein said transfer roller (9) comprises a milling roller.

4. System according to claim 1, wherein said ink train system includes an ink supply roller (3);

and wherein said first operating means comprises adjustable means (17, 18, 19) positioning the ink distribution roller means (7, 8) with respect to said ink supply roller (3) in predetermined location.

5. System according to claim 4, wherein said adjustable means comprises a stop means (18, 19) cooperating with a fixed stop (17) located on the frame of the machine to position the rollers moved upon pivoting movement of the outer plate with respect to the ink supply roller and said plate cylinder in predetermined, adjusted location.

* * * * *

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United States Patent [19] [11] **4,399,767**
Simeth [45] **Aug. 23, 1983**

[54] **VARNISHING UNIT IN THE DELIVERY UNIT OF A SHEET-FED ROTARY PRINTING PRESS**

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[73] Assignee: **M.A.N.-Roland Druckmaschinen Aktiengesellschaft**, Fed. Rep. of Germany

[21] Appl. No.: **386,656**

[22] Filed: **Jun. 9, 1982**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 374,150, May 3, 1982, abandoned.

[30] **Foreign Application Priority Data**

May 6, 1981 [DE] Fed Rep of Germany 3117855

[51] **Int. Cl.**[3] **B05C 11/00**
[52] **U.S. Cl.** **118/46**; 101/232; 118/236; 118/239; 118/249
[58] **Field of Search** 118/46, 236, 239, 249; 101/232

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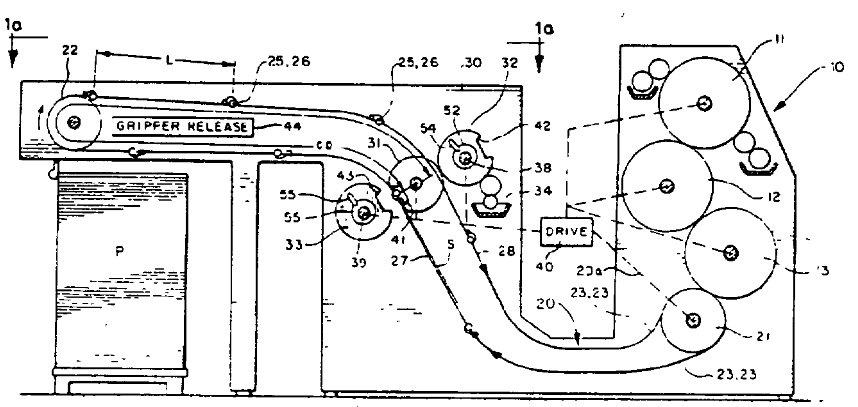
Primary Examiner—Evan K. Lawrence

Attorney, Agent, or Firm—Leydig, Voit, Osann, Mayer & Holt, Ltd.

[57] **ABSTRACT**

An apparatus for varnishing a sheet being fed from a sheet fed printing press into a delivery unit, the sheet being conveyed by an endless loop conveyor made up of a pair of laterally spaced conveyor chains. Cross members extend between the chains at regular intervals carrying grippers for the leading edge of successive sheets. The chains are guided to form a delivery run and a return run spaced apart and generally parallel to one another. An applicator cylinder is journalled between the runs having an axial length which is shorter than the lateral spacing between the chains. A plate cylinder journalled in the frame outside of the return run is in rolling engagement with the applicator cylinder for supplying a varnish film thereto. A backing cylinder journalled in the frame outside of the delivery run is in rolling engagement with the applicator cylinder. The circumference of the cylinders equals the spacing between successive cross members and grippers. The applicator, plate, and backing cylinders have respective longitudinal grooves sufficiently large to provide free passage for the cross members and associated grippers. The cylinders are driven synchronously with the conveyor chains so that a sheet passing on the grippers is engaged between the applicator and backing cylinders for application of varnish to the sheet. The conveyor speed is less than the press speed in a predetermined ratio. The cylinders have a diameter less than the diameter of the cylinders in the associated press unit in the same ratio.

10 Claims, 5 Drawing Figures



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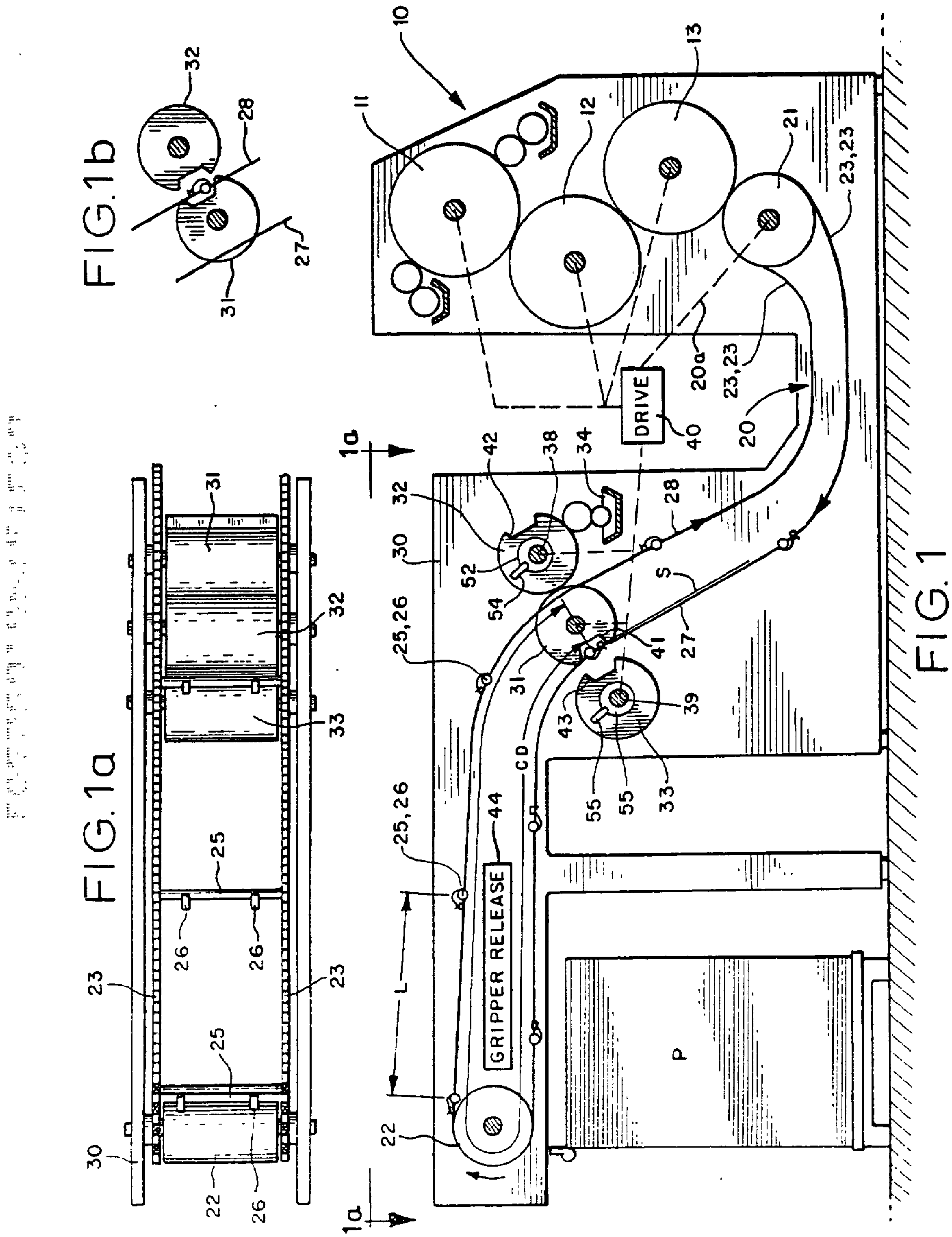


FIG.1b

FIG.1a

FIG.1

FIG. 2

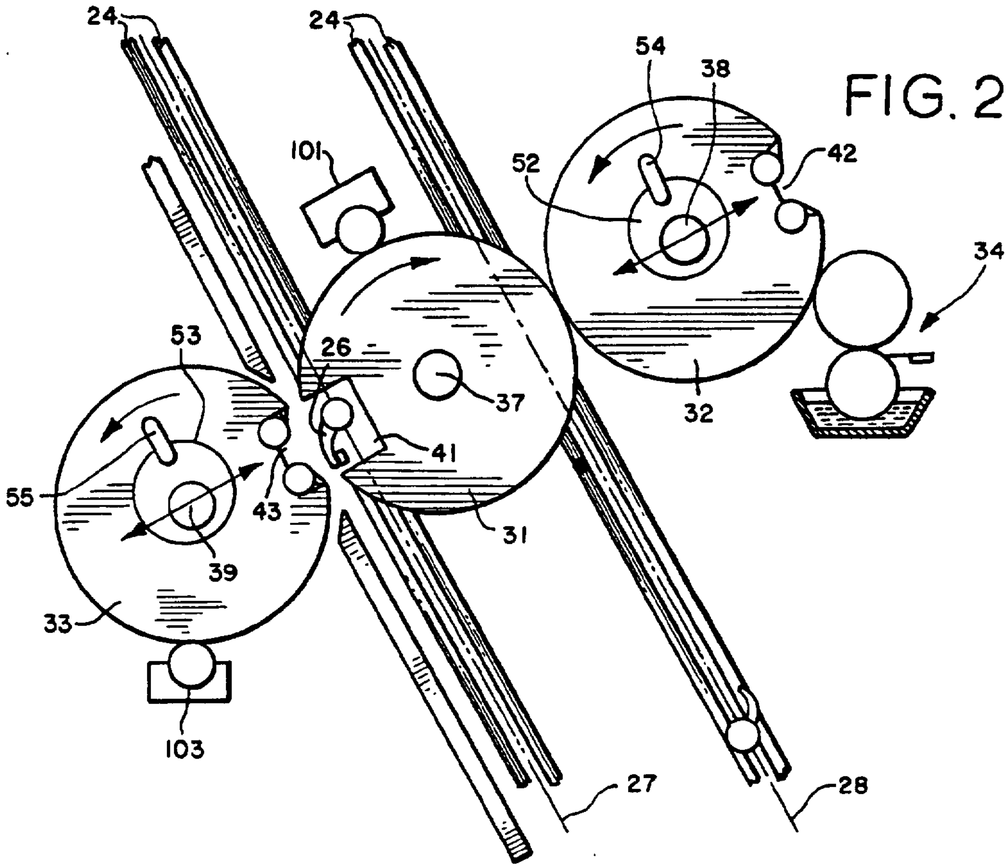
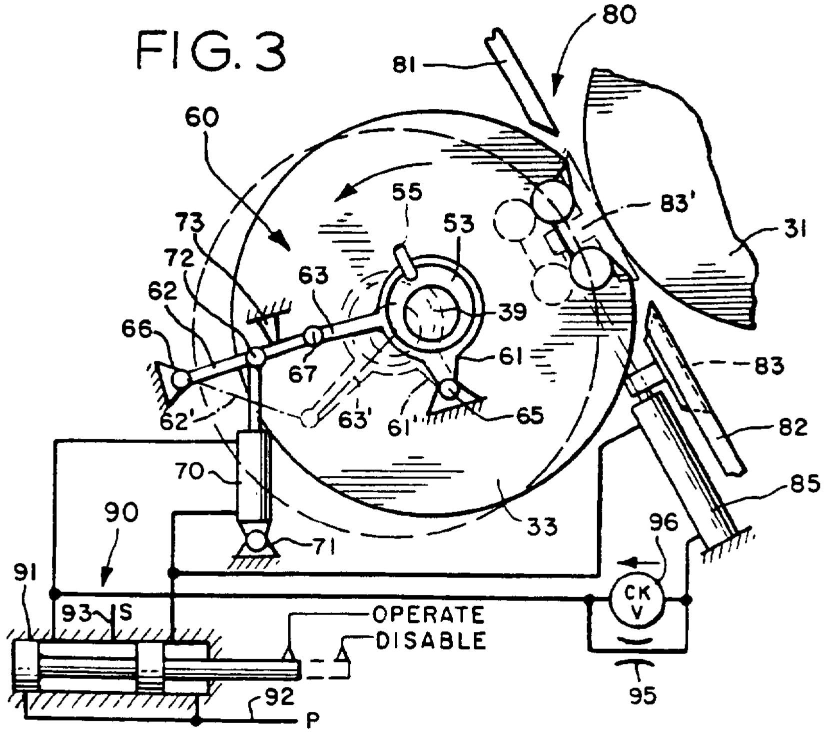


FIG. 3



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VARNISHING UNIT IN THE DELIVERY UNIT OF A SHEET-FED ROTARY PRINTING PRESS

This application is a continuation-in-part of application Ser. No. 374,150, filed May 3, 1982, abandoned.

It is known to modify a damping unit in the last printing unit of a printing press to apply varnish to a printed sheet. It is also known to use a separate varnishing unit in the path of the sheets being conveyed from the printing press to the delivery unit.

German Pat. No. 2,020,584 shows application of varnish by the dampening unit of the last printing unit, by a varnishing unit on the last blanket cylinder and by a varnishing unit on a separate sheet guide cylinder. In each case, however, varnishing is at the expense of the last printing unit in the press which must be cut out or modified. An additional printing unit for the application of varnish downstream of the last ink printing unit requires two additional transfer stations, which is quite costly in addition to complicating the construction and maintenance of the machine.

German Pat. No. 2,345,183 describes a varnishing unit which is mounted in the delivery unit instead of in the printing unit. However this requires an additional sheet transfer comprising a transfer and take-off drum with grippers and control means. Again, the machine is quite complicated and costly.

German Pat. No. 1,930,317 teaches the possibility of conveying printed sheets through a number of printing units successively in one gripper operation by means of a transportation system consisting of chains, grippers and guides. However this is a costly system since it acquires large reversing wheels at the ends of the machine to enable the empty run of the transportation system to be returned beneath the printing units.

It is, accordingly, an object of the present invention to provide a simple and readily accessible arrangement for accurate-register varnishing which can be incorporated in the delivery unit of the sheet fed printing press without any appreciable expense in terms of space and material, while the printing units of the machine are not required to be modified or disabled and hence are always available for printing. It is a related object to provide means for achieving accurate-register varnishing which does not require the use of auxiliary transfers by transfer drums of the like and during which the varnishing takes place as a sheet follows a straight line conveyance path.

It is more particularly an object of the invention to provide a varnishing means for use in a delivery which employs a minimum number of parts, which is easily installed and serviced with convenient access, and which is capable of being economically installed in new delivery units or, on a retrofit basis, in units already in the field to provide the advantages of varnishing at lowest possible cost.

It is still another object of the present invention to provide a device of the type described which is highly compact, a device in which both the delivery run and return run of the conveyor have free passage through a groove in the applicator cylinder without necessity for any special synchronizing means, and in which the cylinders are so arranged as to facilitate impression adjustment and throw off.

Other objects and advantages of the invention will become apparent upon reading the attached detailed

description and upon reference to the drawings in which:

FIG. 1 is an elevational view, somewhat diagrammatic, of a delivery unit for a printing press incorporating provision for varnishing in accordance with the present invention.

FIG. 1*a* is a partial top view of the delivery unit shown in FIG. 1 looking down along the line 1*a*—1*a* therein.

FIG. 1*b* is a fragment showing free passage of cross member and grippers in the return run.

FIG. 2 is an enlarged view of a portion of FIG. 1.

FIG. 3 is a further enlargement showing the provision for throw-off of the backing cylinder and the simultaneous insertion of a sheet guide segment.

While the invention has been described in connection with a preferred embodiment, it will be understood that I do not intend to be limited to the particular embodiment shown but intend, on the contrary, to cover the various alternative and equivalent constructions included within the spirit and scope of the appended claims.

Turning now to FIG. 1 of the drawings there is shown, in diagrammatic form, a lithographic printing press unit 10 having the usual plate cylinder 11, blanket cylinder 12 and impression cylinder 13. This unit, either acting alone or in tandem with preceding press units, achieves printing on at least one side of the sheet, the sheet being indicated as S. The printing unit 10 discharges into a conveyor 20 having an input drum 21 and output drum 22. The conveyor is formed of a pair of laterally spaced closed loops of conveyor chain 23 which are trained around sprockets on the drums, the chains being guided between the drums along guide rails 24 (see also FIG. 2). Extending between the loops of chain 23 are cross members 25 which are spaced at equal intervals along the entire length of the chain, the cross members carrying pairs of grippers 26 which grip and transport the leading edges of successive sheets. The conveyor chains are supported to form a relatively straight and parallel delivery run 27 leading from the press unit to the pile P and an idle or return run 28.

In accordance with the present invention an applicator cylinder is journalled in the frame 30 of the delivery unit between the runs 27, 28 and having an axial length which is shorter than the lateral spacing between the chains. A plate cylinder journalled in the frame outside of the return run 28 is in rolling engagement with the applicator cylinder. A backing cylinder is journalled in the frame outside of the delivery run 27 for rolling engagement with the applicator cylinder. The circumference of the plate cylinder, applicator cylinder and backing cylinder is the same and equal to the spacing between successive grippers or cross members. At least the applicator cylinder has a longitudinal groove of sufficient size to provide free passage for the cross members and their associated grippers. The cylinders are driven in synchronism with the conveyor chains so that a sheet passing on the grippers is engaged between the applicator and backing cylinder for application of a film of varnish to the face of the sheet.

Thus, referring to FIGS. 1 and 2, an applicator cylinder 31 is journalled in the frame 30 of the delivery unit between the runs 27, 28, the applicator cylinder having an axial length which is shorter than the lateral spacing between the chains (see FIG. 1*a*). For furnishing a film of varnish to the applicator cylinder a plate cylinder 32 is provided, the cylinder being journalled outside of the

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return run 28. For applying back up as the sheet is engaged by the applicator cylinder, a backing cylinder 33 is located outside of the delivery run 27.

A varnish fountain 34 acts as a source of varnish for the plate cylinder 32. The plate cylinder 32 carries plates (not shown) which accurately determine the area of the applicator cylinder to which varnish is supplied which, in turn, determines the area over which varnish is applied to the sheet S. The cylinders have respective shafts 37, 38 and 39. As stated, the circumference of each of the cylinders is equal to the spacing L of the successive grippers and cross members. The cylinders and conveyor have a common drive 40.

The conveyor drive connection 20a which drives the conveyor 20 is such that the speed of the conveyor is less than press speed in a predetermined ratio. The applicator cylinder 31, plate cylinder 32 and backing cylinder 33 have a diameter and surface speed which is less than the diameter and surface speed of the cylinders in the associated press unit 10 in the same ratio.

In carrying out the invention the applicator cylinder 31 is provided with a groove 41 large enough to provide free passage for the cross members 25 and the grippers 26 thereon in the delivery run 27. The plate cylinder 32 and backing cylinder 33 have mating grooves 42, 43 respectively which are preferably of similar span.

In operation, with the cylinders 31-33 driven in synchronism with the conveyor chains, the cross members and grippers pass freely between the cylinders 31, 33 and a sheet S, passing on the grippers is engaged between the applicator and backing cylinders for application of a film of varnish to the face of the sheet. When the sheet leaves the cylinders 31, 33 it passes to a position above the delivery pile P where the grippers are released by an automatic gripper release mechanism 44 so that the sheet is deposited on the pile. The grippers thus return empty over the upper, or return run 28 of the conveyor.

In accordance with one of the aspects of the invention in its preferred embodiment, the spacing between the delivery run 27 and the return run 28 is less than the diameter of the applicator cylinder 31 so that the applicator cylinder is more or less symmetrically overlapped by each of the runs. The length of the conveyor delivery and return loop defined by the applicator cylinder, and indicated at CD in FIG. 1, is preferably equal to $NL+L/2$ where N is a low integer and L is the gripper-to-gripper spacing so that the cross members and grippers passing in the return run are freely and idly accommodated in the groove 41 of the applicator cylinder and in the mating groove 42 of the plate cylinder which rotate in synchronism with one another. This condition of idle accommodation is shown in FIG. 1b. In short, the successive cross members and grippers are accommodated in the groove 41 of the applicator cylinder 31 in both the delivery and return directions resulting in a high degree of compactness of the assembly. The fact that the three cylinders 31, 32 and 33 are of a diameter less than the diameter of the cylinders in the regular printing press unit 10 similarly contributes to compactness.

For the purpose of adjusting the plate cylinder 32 back and forth with respect to the applicator cylinder 31, an eccentric sleeve 52 is provided. Moreover, for adjusting the backing cylinder in a direction toward and away from the applicator cylinder, a similar eccentric sleeve 53 is provided. Such sleeves, having operating handles 54, 55 respectively, are duplicated at the opposite ends of the cylinders. Slight rocking movement of the sleeve 52 increases, or decreases, the impression of the plate cylinder with respect to the applicator cylinder, while rocking the eccentric sleeve 53 of the backing cylinder, on the other hand, provides independent control of the impression between the backing and applicator cylinders.

In accordance with one of the detailed aspects of the present invention the backing cylinder 33 is mounted upon a swingable throw-off linkage for swinging between a working position in which the backing cylinder is in engagement with the applicator cylinder and a retracted position in which the backing cylinder is spaced at least 20 millimeters away from the applicator cylinder. The linkage in the present instance, generally indicated by the numeral 60 (FIG. 3), includes a first arm 61 which mounts the shaft 39 of the cylinder, a second or actuating arm 62, and an intermediate link 63. The arms 61, 62 are pivoted to the frame of the machine at pivots 65, 66 respectively, while the arm 62 is connected to the link 63 by a pivot 67.

For the purpose of swinging the actuator arm 62 from its retracted position to the illustrated working position, a pneumatic or hydraulic actuator 70 is used pivoted to the frame at 71 and pinned, at 72, to the central portion of the arm 62. A limit stop, or reference stop, 73 defines the limit of movement of the arm 62 slightly beyond dead center and hence the degree of extension of the actuator.

When the actuator 70 is in its expanded state, the eccentric sleeve 52 is in working position but subject to rocking movement for control of impression as discussed above. When the actuator 70 is, on the other hand, contracted, the arm 62 is drawn away from the stop 73 and the elements comprising the linkage 60 retreat to the retracted positions 61', 62' and 63' shown by the dotted lines in FIG. 3. Using the geometry shown, the backing cylinder will be withdrawn from the applicator cylinder by an amount which substantially exceeds 20 millimeters.

As a further feature of the invention the throw-off mechanism includes a sheet guide segment with means for interposing the segment between the backing cylinder and the applicator cylinder as the backing cylinder is retracted, so that the sheet is not pressed into engagement with the applicator cylinder and does not receive any varnish. Thus, referring again to FIG. 3, the sheet guide 80 normally consists of two spaced sections 81, 82 having a gap between them enabling the backing and applicator cylinders 31, 33 to engage one another. In carrying out the invention a bridging segment 83 is provided mounted on the plunger of an auxiliary actuator 85 so that the segment 83 normally occupies its retracted position but, upon extension of the actuator 85, occupies its bridging position 83' shown by the dotted outline.

The movements of the actuators 70, 85 may be coordinated by connecting them in a hydraulic circuit generally indicated at 90 having a spool valve 91 connected to a source of pressurized fluid 92 and to a sump 93. In the condition of the mechanism illustrated in FIG. 3 the actuator 70 is pressurized for extension and the actuator 85 is pressurized for retraction, which is the operating condition. When it is desired to retract the blanket cylinder, the spool in the valve 91 is shifted into the dotted "disable" position in which the actuator 70 is pressurized for retraction and the actuator 85 is pressurized for extension. When it is desired to retract the backing

cylinder, the spool in the valve 91 is shifted into the dotted "disable" position in which the actuator 70 is pressurized for retraction and the actuator 85 is pressurized for extension. A restriction 95 in the line leading the actuator 85 ensures a time delay in the extension of the guide segment to permit time for the backing cylinder to get out of the way. The restriction 95 is, however, bypassed by a check valve 96 to ensure rapid retraction of the guide segment when the backing cylinder is moving back into its operating position.

The thickness of the film of the varnish applied by the applicator cylinder to the sheet is dependent, in part, upon the surface of the applicator cylinder. A minimum of varnish is applied when the surface of the applicator cylinder is smoothly polished. A maximum is applied when the applicator cylinder has a matt or "screened" surface. In accordance with one of the aspects of the present invention the applicator cylinder has means for alternatively mounting thereon replaceable surface elements of conforming cylindrical shape having (a) a smooth polished surface and (b) a matte surface, respectively. In the simplest aspect of the invention the wrap-around elements may be in the form of a thin metal sheet (not shown) of the wrap-around type, with the ends of the sheet being held by any convenient flexible plate lockup of conventional design (also not shown).

To facilitate clean up, separate washing units 101, 103 may be mounted for bringing into engagement with the surfaces of the applicator cylinder 31 and a backing cylinder 33, respectively, it being understood that such washing units are per se well known in the art. In practice the backing cylinder 33 is covered with a resilient blanket which may be substituted by a blanket having a different degree of stiffness, as desired. The term "guide rails" as used herein referes to any means which may be used to guide the conveyor chains along predetermined delivery and return runs.

It will be apparent that the objects of the invention have been amply fulfilled. The varnishing cylinders in the delivery accomplish accurate-register varnishing cheaply, conveniently and compactly saving the expense of a separate varnishing unit. When varnish is not required it is a simple matter to throw the control valve 91 into its "disable" position, protection being automatically provided for the passing sheet.

I claim:

1. An apparatus for varnishing a sheet being fed from a sheet-fed printing press unit into a delivery unit comprising, in combination, a frame, guide rails in the frame, a pair of conveyor chains laterally spaced from one another on the guide rails to form an endless loop conveyor extending from the press unit to a delivery pile, the chains having cross members at regular intervals, grippers at the cross members for gripping the leading edge of a sheet, the guide rails being arranged to form a delivery run and return run spaced apart and generally parallel to one another, an applicator cylinder journalled in the frame in a position in which it is overlapped by each of the runs but having an axial length which is shorter than the lateral spacing between the chains, means supported on the frame outside of the return run and in rolling engagement with the applicator cylinder for supplying a film of varnish thereto, a backing cylinder journalled in the frame outside of the delivery run and in rolling engagement with the applicator cylinder, the circumference of the cylinders being equal to the spacing between the successive cross members and grippers, the applicator cylinder having a longitudinal groove sufficiently large to provide free passage for the cross members and associated grippers in both the delivery run and the return run, means for driving the cylinders in synchronism with the conveyor chains so that a sheet passing on the grippers is engaged between the applicator and backing cylinders for application of varnish to the sheet.

2. An apparatus for varnishing a sheet being fed from a sheet-fed printing press unit into a delivery unit comprising, in combination, a frame, guide rails in the frame, a pair of conveyor chains laterally spaced from one another on the guide rails to form an endless loop conveyor extending from the press unit to a delivery pile, the chains having cross members at regular intervals, grippers at the cross members for gripping the leading edge of a sheet, the guide rails being arranged to form a delivery run and return run spaced apart and generally parallel to one another, an applicator cylinder journalled in the frame between the runs having an axial length which is shorter than the lateral spacing between the chains, means supported on the frame outside of the return run and in rolling engagement with the applicator cylinder for supplying a film of varnish thereto, a backing cylinder journalled in the frame outside of the delivery run and in rolling engagement with the applicator cylinder, the circumference of the cylinders being equal to the spacing between the successive cross members and grippers, the applicator and backing cylinders having respective longitudinal grooves sufficiently large to provide free passage for the cross members and associated grippers, means for driving the cylinders in synchronism with the conveyor chains so that a sheet passing on the grippers is engaged between the applicator and backing cylinders for application of varnish to the sheet.

3. The combination as claimed in claim 1 or in claim 2 in which the speed of the conveyor is less than press speed in a predetermined ratio, the cylinders being of the same diameter and surface speed, which diameter and surface speed is less than the diameter and surface speed of the cylinders in the associated press unit in the same ratio.

4. The combination as claimed in claim 1 or in claim 2, the spacing between the delivery run and the return run being somewhat less than the diameter of the applicator cylinder so that the applicator cylinder is symmetrically overlapped by each of the runs, the length of the conveyor delivery and return loop defined by the applicator cylinder being equal to $NL+L/2$ where N is a low integer and L is the gripper-to-gripper spacing so that cross members and grippers passing in the return run are idly accommodated in the groove of the applicator cylinder

5. The combination as claimed in claim 1 or in claim 2 in which the means for supplying a film of varnish includes a plate cylinder.

6 The combination as claimed in claim 1 or in claim 2 in which the backing cylinder is mounted upon a swingable throw-off linkage including a toggle for swinging between a working position in which the backing cylinder is in engagement with the applicator cylinder with the toggle on center and a retracted position in which the backing cylinder is spaced at least 20 millimeters away from the applicator cylinder.

7. The combination as claimed in claim 1 or in claim 2 in which the backing cylinder is mounted upon a swingable throw-off linkage including a toggle for swinging between a working position in which the

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backing cylinder is in engagement with the applicator cylinder with the toggle on center and a retracted position in which the backing cylinder is spaced at least 20 millimeters away from the applicator cylinder and in which the throw-off mechanism includes a sheet guide segment with means for interposing the segment between the backing cylinder and the applicator cylinder as the backing cylinder is retracted so that the sheet is held safely away from the applicator cylinder free of transfer of any varnish therefrom.

8. The combination as claimed in claim 1 or claim 2 in which the applicator cylinder has a smooth polished surface.

9. The combination as claimed in claim 1 or claim 2 in which the applicator cylinder has a matte surface.

10. The combination as claimed in claim 1 or claim 2 in which the applicator cylinder has means for alternatively mounting thereon replaceable surface elements of conforming cylindrical shape having (a) a smooth polished surface and (b) a matte surface, respectively.

* * * * *

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United States Patent [19]

DeMoore

[11] **4,402,267**

[45] **Sep. 6, 1983**

[54] **METHOD AND APPARATUS FOR HANDLING PRINTED SHEET MATERIAL**

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[73] Assignee: **Printing Research Corporation, Dallas, Tex.**

[21] Appl. No.: **242,715**

[22] Filed: **Mar. 11, 1981**

[51] **Int. Cl.**[3] **B41F 21/00**

[52] **U.S. Cl.** **101/419**; 101/422; 101/426; 118/DIG. 15

[58] **Field of Search** .... 101/42.2, 416 R, 417, 101/418, 419, 426; 29/120, 130, 131, 121.3; 118/DIG. 15

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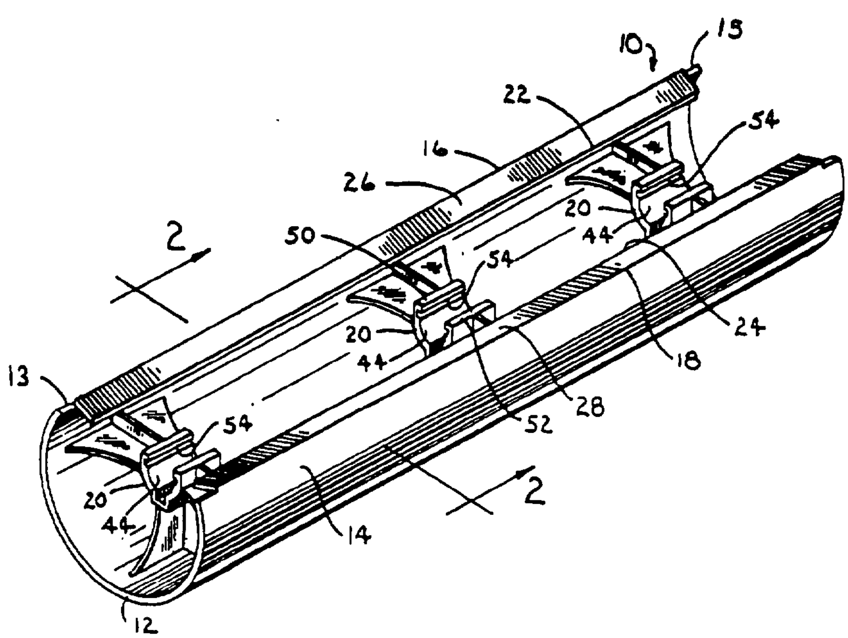
Primary Examiner—Edgar S. Burr
Assistant Examiner—Moshe I. Cohen
Attorney, Agent, or Firm—Fulwider, Patton, Rieber, Lee & Utecht

[57] **ABSTRACT**

A skeleton wheel or cylinder for supporting freshly printed sheet material between printing stations or at the delivery station of a printing press is provided with a loosely retained ink repellent fabric covering for supporting and conveying the sheet material without transfer of wet ink from one sheet to a successive sheet and without smearing the ink or indenting the surface of the sheet material. The circumferential surface of the skeleton cylinder is provided with a coating of a fluorocarbon plastic having a fabric base portion bonded to the surface of the cylinder structure. The low friction properties of the coating permit ease of shuffling movement of the fabric covering and the coating structure provides a cushioning effect to prevent smearing or indenting the sheet material by the fabric cover. The improved cylinder is provided with a plurality of retaining plates slidably fitted in axially spaced hub portions of the cylinder which plates are each locked in place by a set screw. The rim portion of the cylinder includes opposed parallel flanges on which the opposite ends of the fabric covering may be removably retained.

25 Claims, 4 Drawing Figures



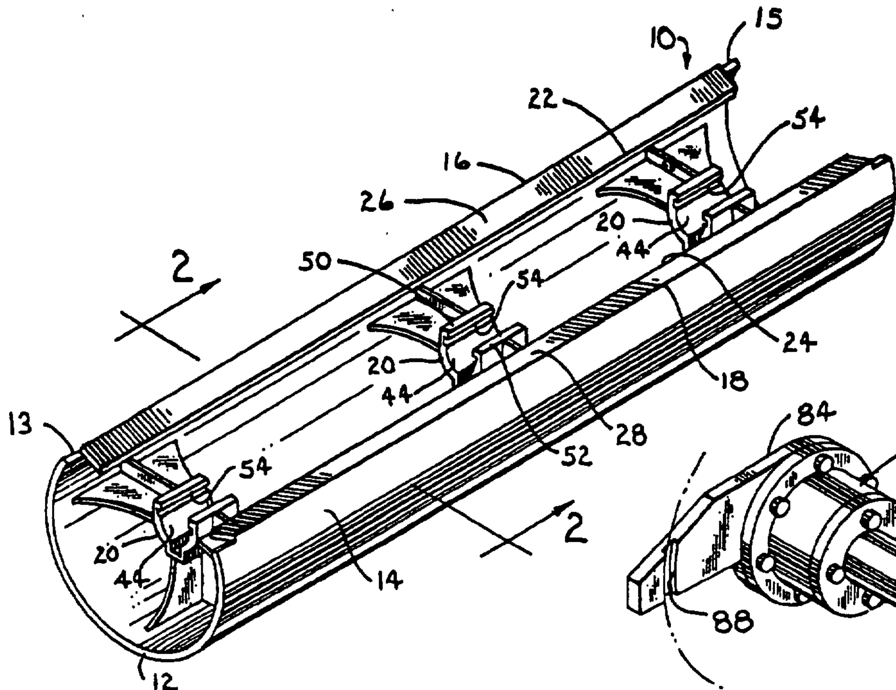


FIG. 1

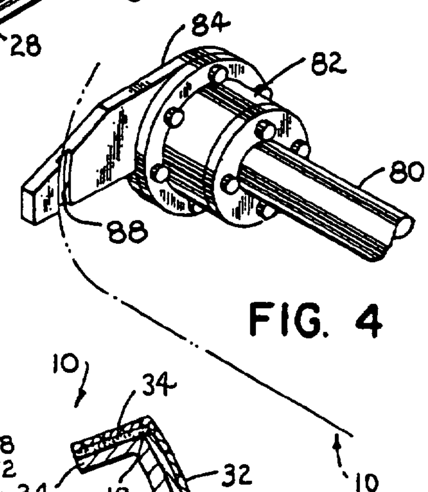


FIG. 4

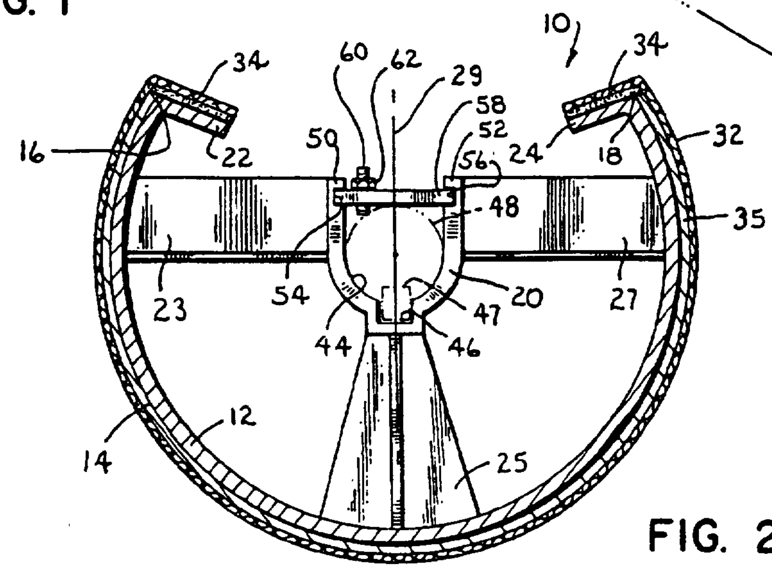


FIG. 2

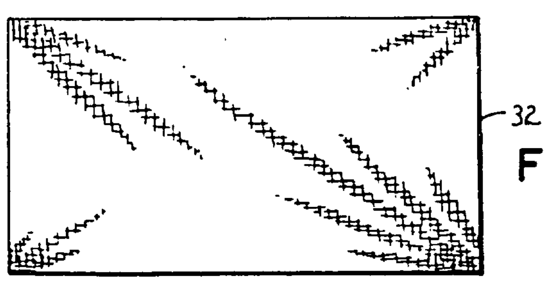


FIG. 3

METHOD AND APPARATUS FOR HANDLING PRINTED SHEET MATERIAL

BACKGROUND OF THE INVENTION

1 Field of the Invention

The present invention pertains to a method and apparatus for providing improved support for freshly inked sheet material in a printing press or the like.

2 Background Art

It has been traditional in the art of printing press apparatus and the like to provide devices for supporting freshly inked sheet material when transferring the material from one printing station to another or when handling the sheets as they are delivered from the press wherein said devices comprise wheels of relatively narrow width and characterized by having circumferentially spaced teeth. Such devices are known by the term skeleton wheels in the printing press art. The problems inherent in handling freshly inked printed sheets and the like by skeleton wheels have been longstanding. In order to minimize the contact area between the skeleton wheels and the printed sheet traditional thinking led to the provision of wheels in the form of relatively thin disks having a toothed or serrated circumference. However, these types of wheels have not overcome the problems of smearing and marring the inked surface of the sheet material due to sliding action between the material and the projections or serrations. Moreover, the attempts to minimize the surface area in contact with the sheet material has also resulted in actual indenting or dimpling of the material itself.

Various efforts have been made to overcome the disadvantages of thin disk skeleton wheels. One of the more successful approaches has been completely contrary to the concept of minimizing the surface area. This more recent development is disclosed and claimed in my U.S. Pat. No. 3,791,644 wherein I provide for a substantially cylindrical drum or roller coated with an improved ink repellent surface comprising a layer of polytetrafluoroethylene. Although this improved skeleton wheel has been commercially successful, with continuous use such as is common in many commercial printing operations, there is over a period of time a slight accumulation of ink on the surface of the wheel.

In high speed commercial printing equipment, for example, it has been determined that in order to provide satisfactory printing quality the surface of the coated wheel must be washed relatively frequently with a solvent to remove any ink accumulation. Moreover, it has also been determined that the TFE coated wheels do not provide a cushioning effect which is important for the tightly stretched sheet material as it engages and is supported by the skeleton wheel.

In accordance with the present invention the problems with the prior art thin disk and other type skeleton wheel concepts have been overcome with a skeleton wheel of relatively great width and with an improved ink repellent and supportive structure which may be used in conjunction with the teaching of U.S. Pat. No. 3,791,644 as well as further improvements which I have made in support and handling apparatus for handling freshly inked sheet material

SUMMARY OF THE INVENTION

The present invention provides an improved method for handling sheet material which has been freshly inked or printed on at least one side wherein the sheet

material is supported by a cylindrical roller or skeleton wheel which has mounted on a cylindrical surface thereof a relatively loose woven fabric or the like. In accordance with one aspect of the present invention there is provided a method for handling freshly printed sheet material in a printing press delivery apparatus or the like wherein a cylindrical roller or skeleton wheel has mounted on the support surface of the wheel a woven fabric of cotton or the like and which is relatively loosely supported on the support surface of the wheel. In accordance with another aspect of the present invention there is provided a method of supporting freshly printed sheet material or the like by means of a cylindrical skeleton wheel or roller having a support surface for a relatively lightweight fabric which is provided by a liquid repellent material of low friction characteristics such as one of the fluoroplastics or the like.

In accordance with another aspect of the present invention there is provided an improved skeleton wheel or roller for a printing press which includes a fabric covered supporting surface for engaging freshly printed sheet material or the like. In a preferred embodiment of the present invention the fabric covering for the skeleton wheel or roller comprises a lightweight cotton fabric or the like treated with a suitable liquid repellant. The fabric is relatively loosely supported on the surface of the cylinder or wheel to accommodate any slight relative movement between the sheet material and the skeleton wheel without marring the freshly inked surface or damaging the sheet material itself. The improved support roller or skeleton wheel of the present invention also contemplates a supporting surface for the fabric covering which may include a low friction fluoropolymer layer.

In accordance with another aspect of the improved skeleton wheel of the present invention the cylindrical support surface for the fabric covering may comprise a coated or impregnated fabric bonded to the cylindrical wheel surface and forming a supporting surface for the loosely secured fabric covering which is directly engageable with the sheet material.

The present invention provides a substantially improved yet simple and reliable handling apparatus and method in the form of a skeleton wheel for printing equipment and the like which is adapted to support sheet material including freshly inked surfaces thereof, without smearing or marking the printed surface and without damaging the sheet material itself. The improved fabric covered skeleton wheel of the present invention is easily installed on a printing press and the fabric covering is easily removed for cleaning or replacement as needed. Those skilled in the art will recognize these advantages as well as other superior features of the present invention upon reading the detailed description which follows in conjunction with the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of the improved skeleton wheel of the present invention before application of the coating and fabric covering.

FIG. 2 is a detail section view taken along the line 2—2 of FIG. 1 showing the layers of materials covering the circumferential surface of the wheel;

FIG 3 is a plan view of a piece of fabric covering adapted for mounting on the skeleton wheel of the present invention; and

FIG. 4 is a detailed perspective view of a portion of a press adapted to use the skeleton wheel of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The improved method and apparatus for handling sheet material in accordance with the present invention is used in a preferred form on high speed printing equipment of the type used, for example, in off-set printing. Such equipment may include one or more support rollers or wheels for handling the sheet material between printing stages and upon delivery of the printed material to a discharge magazine or stack. The particular location of the improved skeleton wheel or roller of the present invention in a typical printing press is believed to be readily understandable to those skilled in the art. Accordingly, a detailed description of the printing press is not believed to be necessary to a complete understanding of the present invention. In any case, reference may be made to my earlier U.S. Pat. No. 3,791,644 which discloses details regarding the location and function of a skeleton wheel for a typical multistation printing press. The present invention may, of course, be utilized with printing presses having any number of printing and delivery stations.

Referring to FIG. 1 of the drawings there is illustrated an elongated member or skeleton wheel generally designated by the numeral 10 comprising the improved skeleton wheel or roller in accordance with the present invention. The skeleton wheel 10 is characterized by a partial cylindrical rim portion 12 which is adapted to be mounted on a press adjacent apparatus, not shown, such as delivery grippers or the like. Accordingly, the outer cylindrical surface 14 of the rim portion 12 has an opening extending the axial width of the skeleton wheel defined by leading and trailing edges 16 and 18, respectively. The skeleton wheel 12 includes a plurality of spaced apart hub portions 20 which may be integrally formed with the rim 12 to comprise a one piece integral casting of aluminum, for example. The hub portions 20 are connected to the rim portion 12 by webs 23, 25 and 27 and are adapted to provide for supporting the skeleton wheel rigidly secured for rotation on a shaft on a printing press in a manner similar to the mounting arrangement disclosed in U.S. Pat. No. 3,791,644 or by an improved arrangement to be discussed herein. As shown in FIG. 1, the skeleton wheel 10 includes opposed elongated integral flange portions 22 and 24 which extend generally inwardly from the surface 14 of the rim 12. The flange portions 22 and 24 include elongated flat surfaces 26 and 28 provided for a purpose to be described further herein.

Referring now to FIG. 2 of the drawings there is illustrated in detail the improved surface construction of the skeleton wheel of the present invention including the fabric covering providing supporting contact with the printed side of a piece of sheet material while conveying the sheet toward a printing station or toward the press delivery magazine. Although the fluoroplastic covered skeleton wheel disclosed in my previous patent provided improvements in handling freshly inked sheet material I have discovered that, unexpectedly, the provision of a layer of fabric on the supporting surface of the skeleton wheel and rather loosely secured thereto further enhances the ability of the skeleton wheel to support and convey successive sheets of printed material with wet ink thereon without transfering the wet ink from a previous sheet to a successive sheet and without marring or depressing the surface of the paper. In accordance with the present invention it has been determined that a woven fabric, preferably cotton, of a relatively loose weave on the order of what is commonly known as gauze has produced the unexpected improvement in a method and apparatus for handling printed material that has wet ink on the surface thereof as it passes over and is supported by the skeleton cylinder. A suitable fabric in accordance with the present invention and illustrated in the embodiment of FIG. 3 comprises a loosely woven, lightweight cotton material such as gauze. A cloth having a forty count or forty mesh, such as the piece of fabric 32 illustrated in FIGS. 2 and 3, treated in accordance with the present invention and attached to the surfaces of the flanges 22 and 24 in a suitable manner has produced the unexpected improvement in the handling of printed sheet material in printing presses and the like. The piece of fabric 32 is preferably of rectangular shape dimensioned to completely cover the outer cylindrical surface of the rim 12.

A preferred method of preparing the fabric piece 32 in accordance with the present invention involves washing the fabric in water in the presence of a suitable fabric softener dissolved therein in rather liberal quantities. One suitable fabric softener which has been used in preparation of the fabric piece 32 is manufactured under the trademark "DOWNY" and, in the washing process, two to three times the normal recommended quantity of softener has been used for washing the fabric in plain water. After washing the fabric piece 32 and allowing same to dry a suitable fabric protector is applied to enhance the liquid repellancy characteristics of the material. A preferred type of fabric protector is manufactured under the trademark SCOTCHGARD by the 3M Manufacturing Company, Minneapolis, Minn. as their Part No. FC4101-C-12. Moreover, it has been determined that even though some ink will accumulate on the surface of the fabric threads over an extended period of operating time the provision of the fabric protector permits the occasional rubbing or agitation of the fabric by the press operator in place on the skeleton cylinder to break loose and remove dried ink particles or crystals which have accumulated on the fabric without requiring removal and washing of the fabric piece.

Referring to FIG. 2 a suitable method of attaching the fabric piece 32 to the outer surface of the rim 12 is by a double sided adhesive tape strip 32 disposed on and extending the length of each of the respective surfaces 26 and 28. Another suitable method of attaching the fabric piece 32 would be by the use of fastener strips such as of the type made under the trademark VELCRO. Those skilled in the art will appreciate that other means may be provided for attaching the fabric piece 32 to the flanges 22 and 24, however, the abovementioned methods provide for quickly attaching and removing the fabric piece 32 with respect to the wheel 10.

An important aspect of the present invention concerns the type of fabric support surface provided on the rim 12 and overlying the surface 14. The improved surface is preferably of a low coeffecient of friction such as may be provided by coating the metal surface 14 of the cylinder with a fluoroplastic as taught by U.S. Pat. No. 3,791,644. Although the combination of the coating described in the abovementioned patent together with the fabric member 32 attached thereover provides suitable performance it has been discovered that the fabric covering for the skeleton wheel 10 per-

forms somewhat better in eliminating any marring or depressions in the surface of the sheet material by the application of a coating including a fabric reinforcement as will be described herein.

Referring to FIG. 2 the rim portion 12 of the skeleton wheel 10 is provided with a coating 35 comprising a fluorocarbon composite coating material applied in one or more coats over a fabric base which is adhesively bonded to the cylindrical circumferential 14 of the rim portion 12. It is believed that the provision of the fabric base for the coating such as described herein provides a cushioning effect for the fabric piece 32 which is applied over the coating 35 and which reduces the tendency for the fabric piece 32 to indent or form depressions in the surface of the sheet material as well as substantially preventing the transfer of wet ink from one sheet to a successive sheet.

In a preferred method of preparing and forming the coating 35 a suitable piece of fabric such as cotton canvas of approximately 0.022 inch nominal thickness and having a waterproofing applied to one side thereof is cut somewhat oversize, approximately 4 to 5 inches all around, from the actual size required to cover the entire surface 14. The fabric is then suitably tacked to a substantially flat and smooth preparation surface to prevent movement or shrinkage while a first coat of the fluoropolymer or fluorocarbon material is applied thereto. A preferred composition for providing the coating 35 is a liquid fluoropolymer coating made under the trademark XYLAN by the Whitford Corporation, Westchester, Pa. A satisfactory coating material of the type referred to hereinabove is XYLAN 1010 composite type coating material which is self curing at room temperature.

After the aforedescribed fabric base is temporarily fastened to a suitable surface with the waterproof side facing said surface the non waterproofed side of the fabric is sanded lightly with a 220 grit paper to bring out the nap of the fabric. One coat of XYLAN 1010 coating material is then applied to the aforedescribed fabric and allowed to cure at room temperature. Once the first coating layer has been allowed to dry the coated fabric is removed from the temporary preparation surface and bonded to the surface 14 of the rim 12 using a suitable adhesive such as a contact cement made by 3M Corporation. The surface of the coated fabric piece which is applied to the surface of the rim portion 12 is the waterproofed side. The surface 14 is normally prepared for application of the adhesive in the prescribed manner to be clean and dry. Care should be taken to roll out the coated fabric piece of the coating 35 when it is applied to the surface 14 to prevent entrapment of air bubbles or the like.

After the adhesive is allowed to dry the fabric is trimmed to size and additional coatings of the fluoropolymer are applied and allowed to dry between coats. A suitable coating 35 is formed by the application of three additional layers of XYLAN 1010 coating material after the fabric base has been bonded to the surface of the rim 12. The surface formed by the coating 35 is preferably sanded lightly between each coat of fluoropolymer with, for example, 400 grit finishing paper.

The preparation of the surface coating 35 as aforedescribed provides a substantially glazed surface with a low coefficient of friction which is ink repellent and also provides for ease of movement of the fabric piece 32 when the same is attached to the cylinder 10. Although, in accordance with the present invention, the fluoropolymer coating described is particularly advantageous it is contemplated that other low friction plastic coatings may be applied to the aforementioned fabric base to produce a suitable surface for the fabric member 32. The particular fluorocarbon type coating of the general class of coatings referred to herein has produced the unexpected improvement of reducing ink transfer of one sheet to another in high speed printing equipment and has also, in combination with the fabric member 32, reduced depressing or indenting of the paper surface of the sheets. After the coating 35 has been prepared the fabric piece 32 is applied to the flanges 22 and 24 by the adhesive stripes 34 or other suitable fastening means loose enough so that with normal finger pressure the fabric may be locally moved over the surface of the coating 35 in all directions at least one eighth inch to one inch. Moreover, in printing presses in which the drive train has become loose with wear, for example, relative movement between the press impression cylinder and the skeleton wheel will not result in smearing of the ink thanks to the movability of the fabric covering with respect to the cylinder rim.

The improved skeleton wheel or cylinder of the present invention also includes improved means for attaching the wheel to the associated driving shaft of the printing press. Referring to FIGS. 1 and 2, the spaced apart hub portions 20 are provided with semi-cylindrical support surfaces 44 which are intersected by a suitable keyway 46 in which may be disposed a key 47 for drivingly engaging the skeleton wheel 12 with a press drive shaft indicated by the numeral 48 in FIG. 2. The hub portions 20 are provided with an improved retention means for mounting the skeleton wheel 10 on the shaft 48. The spaced apart hub portions 20 are each formed with integral axially extending bosses 50 and 52 spaced apart sufficiently to allow the skeleton wheel to be slipped radially on and off of the shaft 48. The bosses 50 and 52 are provided with opposed axially extending slots 54 and 56, respectively, which are aligned with each other to permit the insertion of a retaining plate 58. The retaining plate 58 is preferably of a length slightly less than the span between the bottoms of the grooves 54 and 56 so that the plate fits snugly in the respective grooves. The plate is preferably of a width equal to the axial length of the bosses 50 and 52. As shown in FIG. 2, the retaining plate 58 is provided with a socket head lock screw 60 threadedly engaged with the retaining plate and provided with a suitable lock nut 62. The lock screw 60 is offset from the center line which bisects the opening between the spaced apart bosses 50 and 52.

The lock screws 60 are adapted to be tightened to engage the periphery of the shaft 48 to prevent axial sliding of the skeleton wheel 10 with respect to the shaft and to permit minor radial adjustment of the skeleton wheel with respect to the shaft. When installing the cylinder 10 on the shaft 48 or removing the cylinder from the shaft the improved retaining plate 58 may be inserted in and removed from the respective grooves 54 and 56 followed by tightening or loosening of the screws 60, as the case may be, to provide a simplified arrangement for mounting and removing the cylinder with respect to the associated press drive shaft. The leading and trailing edges 16 and 18 are advantageously disposed substantially equidistant from the centerline 29 so that in some applications the skeleton wheel 10 can be turned end for end when the leading edge becomes worn or damaged.

Another feature of the present invention which has permitted improved retrofitting of a skeleton wheel such as the wheel 10 on certain types of press equipment is provided by the axially extending portions 13 and 15 of the rim 12 which extend in opposite directions respectively from the flanges 22 and 24. In certain types of presses such as a model TP-38A made by the Miller Printing Equipment Companpy one or more stationary side plates are located adjacent ends of the skeleton wheel or cylinder and are positioned such that certain lengths of printed material will overlap the side plates and will be disfigured while being conveyed past the plates under the support of the skeleton wheel because the wheel cannot be moved axially on the shaft to the non printed area of the sheet. However, with the improved skeleton cylinder 10 having the axially extending rim portions 13 and 15, a suitable annular groove may be cut in the side plates to accommodate the axial length of the wheel 10 to thereby substantially support the full length of the sheet material as it is conveyed by the wheel.

Referring to FIG. 4 there is shown a detail view of a portion of a skeleton wheel support shaft 80 similar to the shaft 48. The shaft 80 is supported in a bearing assembly 82 which is bolted to a support assembly including a side plate member 84. The plate 84 is stationary and prevents the use of a skeleton wheel or cylinder having a length substantially equal to the length of the sheet and providing adequate support thereof. However, by forming the annular groove 88 to have radial and axial dimensions with respect to the longitudinal centerline of the shaft 80 sufficient to clear the axial end portions 13 or 15 of the rim 12, the cylinder 10 may be installed on a press equipped as shown to support substantially the entire length of the sheet material.

Those skilled in the art will appreciate that various modifications to the method and apparatus of the present invention may be made without departing from the scope of the invention as defined in the appended claims.

What I claim is:

1. A method for supporting and conveying sheet material which has been freshly printed and discharged from a printing press or the like without marring the freshly inked surface, comprising the steps of:

providing a skeleton wheel having a sheet supporting surface thereon;

providing a piece of fabric;

attaching said piece of fabric to said skeleton wheel to be disposed over at least that part of said surface which supports said sheet material, said piece of fabric being attached relatively loosely to permit and accomodate slight movement between the fabric and the skeleton wheel when the sheet material is supported and conveyed by skeleton wheel and

rotating said skeleton wheel to engage successive sheets of said sheet material in supportive and conveying relationship thereto by said piece of fabric without marring said freshly printed surface.

2. The method as set forth in claim 1 together with the steps of:

providing said piece of fabric of woven cloth.

3. The method set forth in claim 2 wherein:

said cloth is provided of woven substantially qauzelike cotton material on the order of about forty mesh.

4. The method set forth in claim 1 or 3 together with the steps of:

treating said fabric with a liquid repellent prior to attaching said piece of fabric to said skeleton wheel.

5. The method set forth in claim 4 together with the steps of treating said fabric with a fabric softening material prior to treating said fabric with liquid repellent.

6. The method set forth in claim 1 together with the steps of:

providing an ink repellent coating on said surface for supporting said piece of fabric.

7. The method set forth in claim 6 wherein:

said coating includes a polytetrafluoroethylene.

8. The method set forth in claim 6 together with the step of:

providing a fabric base portion for said coating.

9. In a skeleton wheel for supporting and transferring a freshly printed sheet from a printing station on a printing press or the like without marring the freshly inked surface;

a generally cylindrical rim segment having a generally cylindrical support surface formed thereon; and

a fabric covering disposed over at least a part of said support surface for supportively engaging one side of said sheet during the transfer thereof; and

means for securing said fabric covering to extend relatively loosely over said support surface to permit and accomodate slight movement between the fabric covering and said support surface when the printed sheet is supported and transferred by the skeleton wheel so that the freshly printed sheet is not marred.

10. The invention set forth in claim 9 wherein:

said fabric covering comprises woven substantially gauzelike cotton material on the order of about forty mesh.

11. The invention set forth in claim 10 wherein:

said fabric covering is treated with a liquid repellent.

12. The invention set forth in claim 10 wherein said fabric covering is treated with a fabric softening agent.

13. The invention set forth in claim 9 wherein:

said generally cylindrical support surface is delimited in a circumferential direction by opposed elongated flanges, and said skeleton wheel includes means for removably attaching said fabric covering to said wheel along said flanges.

14. The invention set forth in claim 13 wherein:

said means for attaching includes an adhesive strip mounted on said flanges.

15. The invention set forth in claim 13 wherein:

said rim segment extends axially beyond said flanges for supporting substantially the entire length of said sheet.

16. The invention set forth in claim 9 or 13 wherein:

said surface includes a low friction coating thereon.

17. The invention set forth in claim 16 wherein:

said coating comprises at least one layer comprising polytetrafluoroethylene.

18. The invention set forth in claim 16 wherein:

said coating includes a fabric layer on which at least one layer of a fluoropolymer coating is applied.

19. The invention set forth in claim 18 wherein:

said fabric layer is a woven canvas

20. A method of supporting and conveying sheet material which has been freshly inked and discharged

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from a printing press or the like without marring the freshly inked surface, comprising the steps of:

forming an ink repellent coating on a sheet supporting surface of a skeleton wheel;

treating a piece of fabric with a fabric softening agent;

treating the piece of fabric with a liquid repellent subsequent to treatment with said fabric softening agent;

attaching the piece of fabric to the skeleton wheel to cover the sheet supporting surface, said attaching step including mounting the piece of fabric relatively loosely over the sheet supporting surface such that the piece of fabric is capable of accommodating relative movement between the sheet material and the sheet supporting surface substantially without marring or damaging the freshly inked sheet material; and

rotating the skeleton wheel to engage successive sheets of the sheet material in supportive and conveying relation with the piece of fabric.

21. The method of claim 20 wherein said step of forming an ink repellent coating comprises the steps of applying an ink repellent agent to a fabric base portion and securing the fabric base portion to the skeleton wheel.

22. The method of claim 20 wherein the skeleton wheel sheet supporting surface has a generally cylindrical shape interrupted by an opening extending the axial width of the skeleton wheel, said opening being bounded by a pair of generally radially inwardly directed flanges, and wherein said attaching step comprises wrapping the piece of fabric about the sheet supporting surface and securing opposite ends of the piece of fabric respectively to the flanges.

23. A skeleton wheel for supporting and transferring a freshly inked printed sheet from a printing station of a printing press or the like without marring the freshly inked surface, comprising:

a wheel member having a generally cylindrical sheet supporting surface with an ink repellent coating formed thereon;

a fabric covering comprising a woven cloth treated with a fabric softening agent and then treated with a liquid repellent agent; and

means for attaching said fabric covering relatively loosely to said wheel member to cover said sheet supporting surface such that said fabric covering is capable of accommodating sufficient relative movement between a printed sheet supported and transferred thereby and said sheet supporting surface substantially without marring or damaging the printed sheet.

24. The skeleton wheel of claim 23 wherein said ink repellent coating comprises a fabric base portion with at least one layer of a fluoropolymer material applied thereon.

25. The skeleton wheel of claim 24 wherein said fabric base portion is formed from a canvas sheet.

* * * * *

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United States Patent [19]

Fischer

[11] **4,421,027**

[45] **Dec. 20, 1983**

[54] **MULTIPLE PRINTING MODE PRINTING MACHINE SYSTEM**

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[21] Appl. No.: **360,068**

[22] Filed: **Mar. 22, 1982**

[30] **Foreign Application Priority Data**

Apr. 25, 1981 [DE] Fed. Rep. of Germany 3116505

[51] **Int. Cl.**^{3} **B41F 11/00**; B41F 5/24; B41F 7/36, B41L 25/14

[52] **U.S. Cl.** **101/142**; 101/148; 101/177; 101/179; 101/216; 101/352; 101/DIG. 28

[58] **Field of Search** .... 101/DIG. 28, 42 S, 148, 101/147, 349–352, 136, 137, 141, 142, 177, 179, 180, 216, 217, 218, 220

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Primary Examiner—Edgar S. Burr
Assistant Examiner—David A. Wiecking
Attorney, Agent, or Firm—Frishauf, Holtz, Goodman & Woodward

[57] **ABSTRACT**

To permit, selectively, lithographic printing, flexo printing, or direct lithographic printing on a printing machine with the same direction of rotation of the respective cylinders, a liquid application system (**11**) including a liquid application roller (**15**) is selectively positionable for engagement either with a plate cylinder (**4, 5**) of a lithographic system, the rubber blanket cylinder (**2, 3**) for direct lithographic printing, the plate cylinder then acting as a form ink transfer cylinder which is being continuously inked; or for engagement with the blanket cylinder, with a flexo printing plate applied to the blanket cylinder, and the plate cylinder being placed out of engagement with the blanket cylinder, the damping liquid for lithographic printing being replaced by flexo-printing ink, and the position (FIG. 3) being as close to the printing or impression line as possible, and between the zone of operation of the plate cylinder (**4**) and the printing cylinder (**2**) to prevent drying of the quick-drying flexo-printing ink.

8 Claims, 5 Drawing Figures

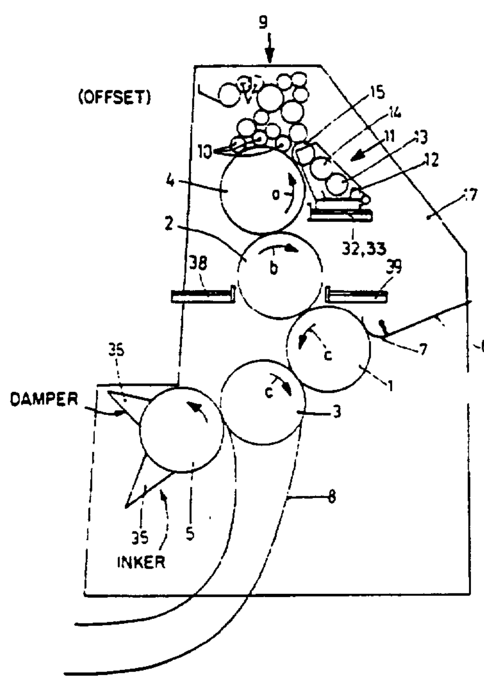

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Fig. 1

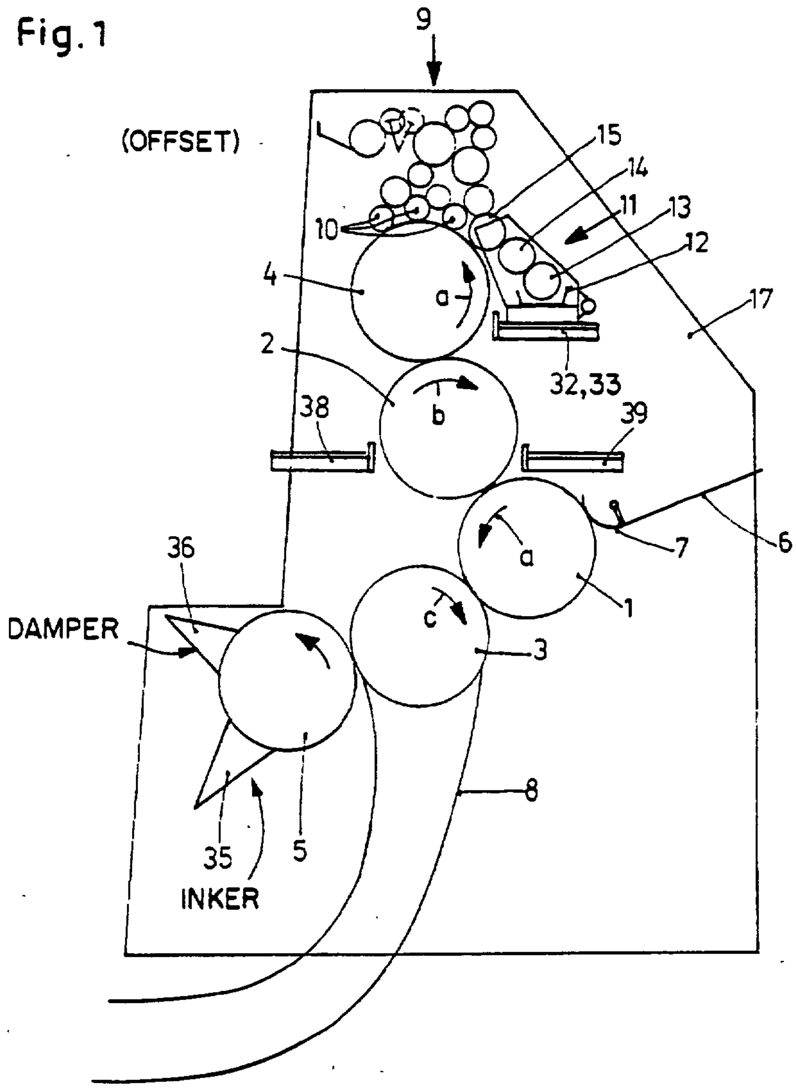

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Fig.2

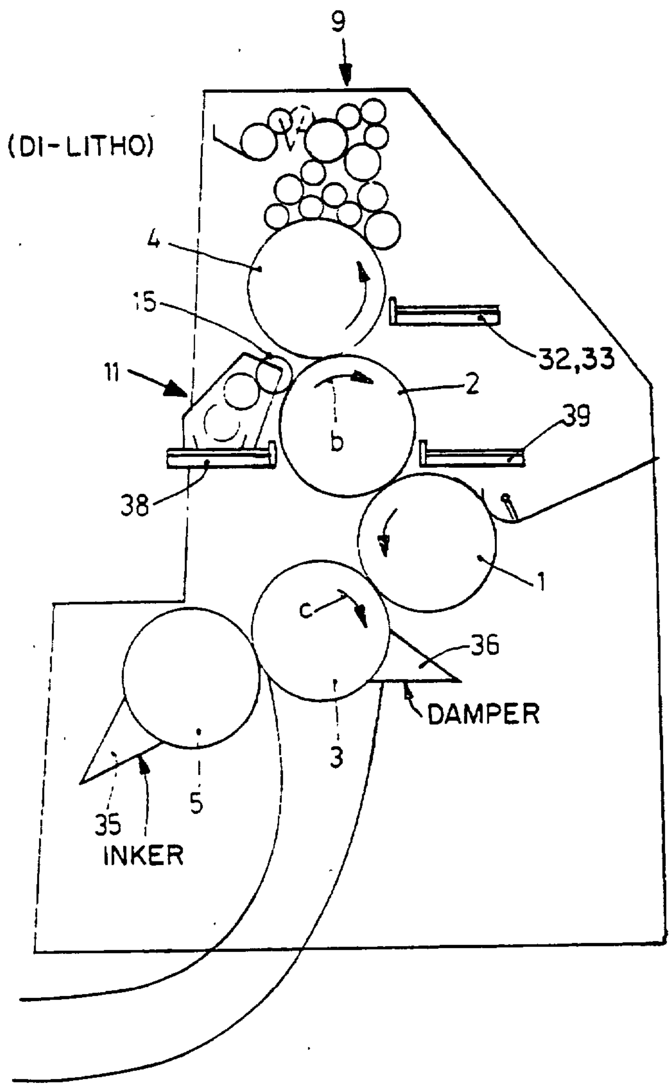


Fig.3

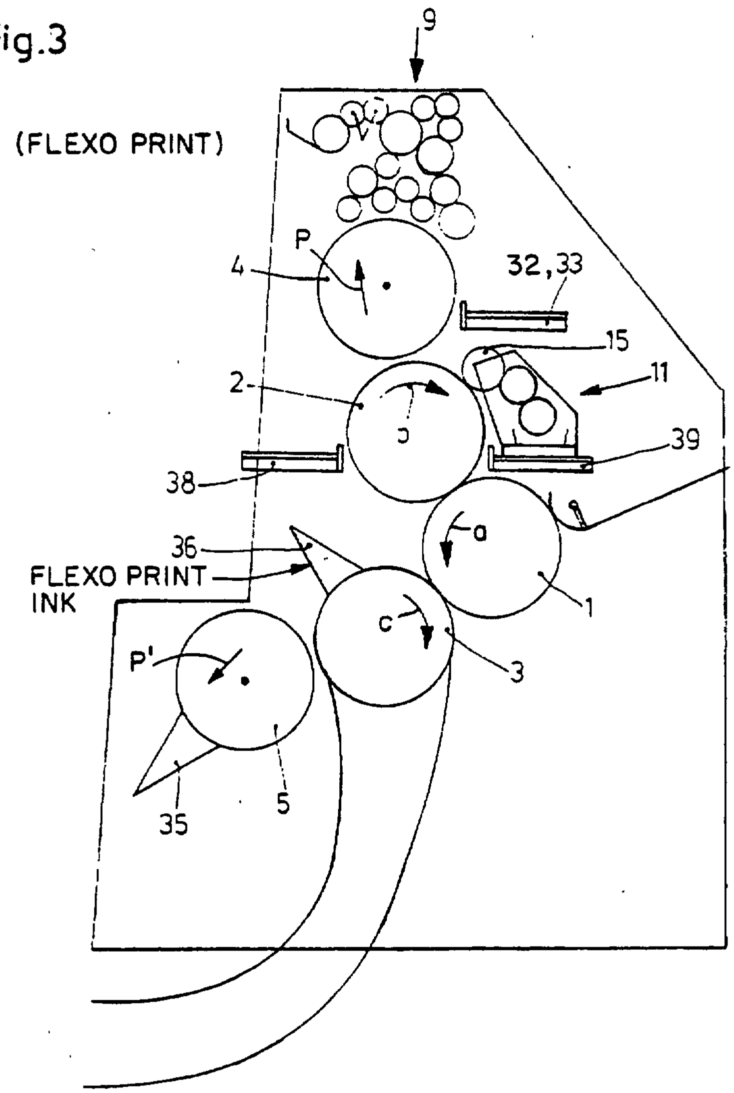


Fig. 4

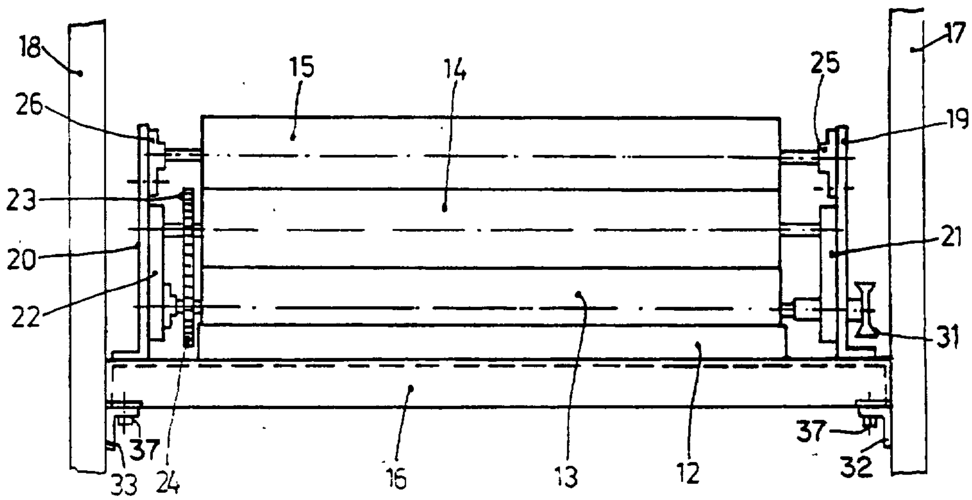
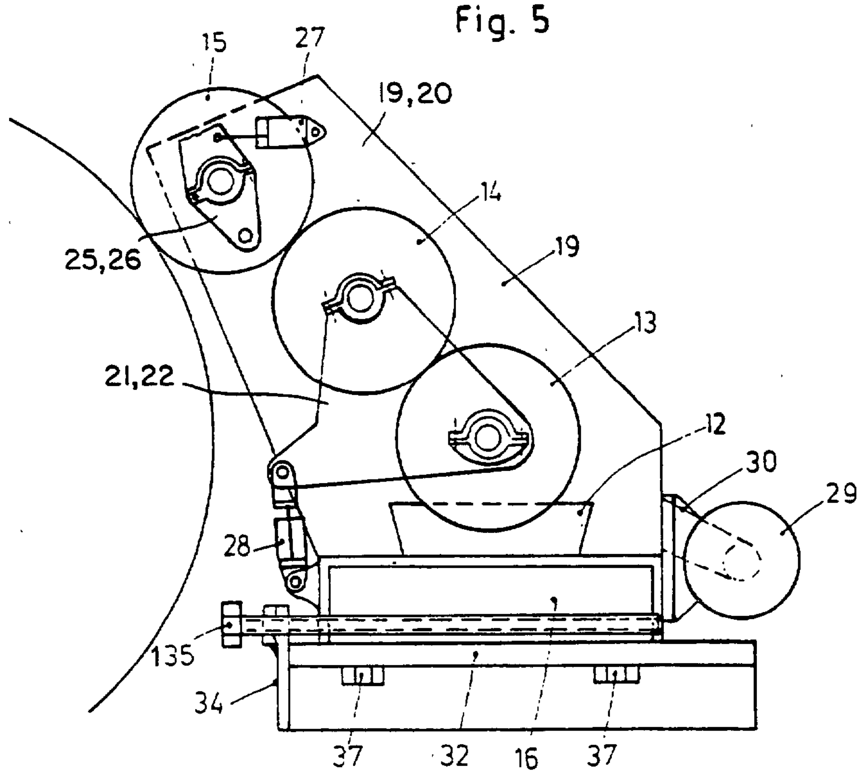


Fig. 5



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MULTIPLE PRINTING MODE PRINTING MACHINE SYSTEM

Reference to related application, assigned to the assignee of the present invention, the disclosure of which is hereby incorporated by reference: U.S. application Ser No. 360,065, filed Mar. 22, 1982 by the inventor hereof, now U.S. Pat. No. 4,397,235, issued Aug. 9, 1983.

The present invention relates to a rotary printing machine system having at least one printing system retaining, within side walls thereof, a plate cylinder and a blanket cylinder, as well as an inker and a damper, and in which the damper can be selectively positioned to permit selectively different printing modes of operation.

BACKGROUND

A machine of a type to which the present invention relates is described in German Published Patent Application No. DE-AS 1 611 239. This machine can operate both in raised letters, or offset printing mode. The cylinders of the printing machine can operate in either direction, so that the paper path on which printing is to be effected can be suitably selected. The paper path is passed through the printing system which includes two plate cylinders and two blanket cylinders. In offset printing, the plate on the plate cylinder continuously has damping liquid applied thereto prior to inking thereof. For damping, a slinger-type damping system is provided, selectively positionable between two positions on the plate cylinger. When raised letter printing is to be effected, the slinger damping system is removed.

THE INVENTION

It is an object to expand the printing mode capability of a machine of the basic type as described to additionally permit operation of the machine utilizing flexo printing, that is, to permit, in dependence on printing job requirements, offset printing, direct lithographic printing or flexo printing.

Briefly, the damping system includes a trough in which a pickup roller dips, supplying liquid to a transfer roller for subsequent supply of liquid to an application roller. The damping system, selectively, can be placed in various working positions, for example by cooperating with the plate cylinder of an offset printing plate, with a blanket cylinder of a direct lithographic printing plate, or, in a third position with a flexo printing plate placed on the rubber cylinder, in which the plate cylinder then is disengaged from contact with the blanket cylinder, the trough of the damping system then being filled with flexo printing ink rather than with offset damping liquid, such as water.

The system has the advantage that the direction of movement of the respective cylinders need not be changed, that is, remains the same regardless of the type of printing mode which is selected. Thus, the invention is applicable to various types of machines, including those which are most simply constructed and can operate only in one direction of rotation. The invention is applicable both to sheet-fed printing machines as well as to paper web-fed machines, without structurally interfering with the basic arrangement of the machine.

DRAWINGS

FIG. 1 is a schematic side view of a printing machine, arranged for standard offset printing;

FIG. 2 is a side view of the machine of FIG. 1, set up for direct lithography (DiLitho) printing;

FIG. 3 is a side view of the machine of FIG. 1 set up for flexo printing;

FIG. 4 is a fragmentary end view, partly cut away, of the damping system of the machine; and

FIG. 5 is a schematic side view of the damping system of FIG. 4 shown to an enlarged scale.

The machine illustrated is capable of printing with two colors in offset mode. A make-ready table (FIG. 1) 6, having grippers 7, supplies a sheet of paper to the impression cylinder 1. One color of printed information is supplied from rubber blanket cylinder 2 and plate cylinder 4. The other color is supplied by a printing system including the rubber blanket cylinder 3 and plate cylinder 5. The sheet is transported out of the printing station by a transport chain system 8, formed with grippers (not shown). The respective grippers on the impression cylinder 1 likewise have been omitted for clarity of the drawings and may be in accordance with any standard construction.

An inker, generally shown at 9, and having a plurality of ink application rollers 10, is located in surface contact with the plate cylinder 4. It may be of any standard and suitable construction. Further, a damper 11 is provided which has a trough 12 of damping liquid in which a ductor roller 13 dips. The ductor roller 13 is in surface contact with a transfer roller 14. Transfer roller 14 may be axially oscillating. A liquid application roller 15 receives liquid from the roller 14 and applies it to the plate cylinder 4 in advance of ink applied by the application rollers 10.

The damper 11 is shown in greater detail in FIGS. 4 and 5. to which reference will be made: a carrier 16 is provided extending from one side wall 17 of the printing machine over to the side wall 18 (FIG. 4). Two plates 19, 20 are secured to the carrier 16. Plates 19, 20 extend parallel to the side wall 17,18. The plates 19, 20 retain two rocking links 21, 22, pivotable or swingable about the axis of rotation of the liquid pickup roller 13 The liquid pickup roller 13 and the transfer roller 14 are journalled between the links 21, 22 and are connected by gears 23, 24. Two further pivot links 25, 26 are located on the plates 19, 20, retaining the liquid application roller 15. The respective links are located in controlled position by hydraulic positioning elements 27, 28, for example cylinder-piston arrangements. By suitable application of hydraulic liquid, the application roller 15 and the transfer roller 14 can be placed, respectively, in quiescent or working position.

The support carrier 16 further supports an electric motor 29 which is connected by a belt drive 30 with a sheave 31, driving the pickup roller 13.

The carrier or support 16, and hence the damper 11, is secured in place at the inner surfaces of the side walls 17, 18 by being supported on support rails 32, 33 attached to the side walls, for example by welding. The ends of the support rails 32, 33 each are formed with a flange 34 through which an engagement bolt 135 is threaded in order to determine the correct position of the carrier 16 and with it the damper 11 with respect to the remaining cylinders and rollers of the printing machine. When properly positioned, the carrier 16 is secured in place on the machine by bolts 37, engaging through elongated holes or slots formed in the rails 32, 33.

A similar system is provided for the plate cylinder 5. The damper 36 and the inker 35 thereof are shown only

schematically, since it may be identical to the arrangement of the damper 11 and the inker 9, or the mirror image thereof.

Operation, Offset Printing with Reference to FIG. 1: The damper 11 is secured on the carrier rails 32, 33. The damping liquid application roller is engaged on plate cylinder 4. Additionally, it may be in contact with one of the rollers of the inker 9 (see FIG. 1). Similarly, the inker 35 and the damper 36 are in engagement with the plate cylinder 5.

Upon starting of the machine, plate cylinders 4, 5 first have damping liquid applied thereto and thereafter they are inked. The printing information is transferred to the blanket cylinders 2, 3. Upon rotation in the direction of the arrow a of the impression cylinder, the sheet supplied by the grippers 7 from the make-ready table 6 is first printed by a first color ink by blanket cylinder 2 and, upon subsequent transfer of the sheet to the impression or printing line between impression cylinder 1 and blanket cylinder 3, printing with a second color ink is effected.

DiLitho Mode, FIG. 2: The damper 11 is removed from the rail 32. In accordance with a feature of the invention, a further set of rails 38 is located on the side walls 17, 18 of the machine to receive the damper 11 as a unit. The damper 11, thus, is applied to the second set of rails 38 (FIG. 2). In this mode of operation, the liquid application roller 15 is in engagement with the rubber blanket cylinder 2.

In similar manner, the damper 36 is applied to the blanket cylinder 3. The plate cylinders 4, 5 are coated with a continuous film of ink and thus provide, in effect, a continuous inking surface and form part of the inking system. For example, a rubber blanket may be applied to the plate cylinder. The blanket cylinders 2, 3 have a direct lithographic printing plate secured thereto.

The set of rails 38 is so arranged that the application roller 15 of the damper 11 contacts the circumference of the blanket cylinder 2 between the printing or impression line thereof, with respect to the impression cylinder 1, and the contact line of the plate cylinder 4, looked at in the direction of the arrow b. Similarly, the damper 36, again looked at in the direction of the arrow c, is positioned between the impression line between the blanket cylinder 3 and the impression cylinder 1 and the contact line between the blanket cylinder 3 and the plate cylinder 5. Consequently, in operation, the DiLitho plate on the blanket cylinder 2 is first wetted by the damper and thereafter inked by the plate cylinder 4. Similarly, the DiLitho plate on the blanket cylinder 3 is first wetted and then inked. Thereafter, printing is effected between the blanket cylinder 2 and the impression cylinder 1 in one color ink, and between the blanket cylinder 3 and the impression cylinder 1 with another color, for example.

Flexo Printing with Reference to FIG. 3: In accordance with a feature of the invention, a third set of rails 39 is secured to the side walls of the machine 17, 18. The third set of rails is used to locate the damper 11 when flexo printing is desired. The liquid application roller 15 is engaged with the blanket cylinder 2. Similarly, the damper 36 is engaged with the blanket cylinder 3. Contrary to the position for DiLitho printing, however, the application roller 15 is so positioned that it is as close as possible to the printing or impression line with the impression cylinder 1. The plate cylinders 4, 5 are removed from contact with the blanket cylinders 2, 3, for example by rocking the centers of rotation of the respective shafts by a link, an eccenter, or the like as schematically shown by arrows P, P'.

The blanket cylinders 2, 3 each have a flexo printing plate secured thereto. The damping liquid is removed from the trough 12 of the damping system and flexo printing ink is placed therein. The set of rails 39 is so arranged that the application roller 15 of the system 11 contacts the circumference of the blanket cylinder 2, looked at in the direction of rotation of arrow b, between the zone close to the plate cylinder 4 and the impression line of the printing cylinder 1.

The arrangement of the damping, or liquid application system 11, as described, permits application of flexo printing ink shortly before the flexo printing plate on the plate cylinder 2 reaches the impression line with the impression cylinder 1, so that drying of the rapidly drying flexo ink on the plate of the blanket cylinder 2 is prevented.

Similarly, the liquid application system 36 with respect to the lower printing system is repositioned as shown in FIG. 3, so that the blanket cylinder 3, which will have a flexo printing plate applied thereto, will have flexo printing ink applied thereon shortly before reaching the impression line with the impression cylinder 1. Printing is effected in two-color prime printing.

Various changes and modifications may be made, and the modes of printing operation can be selected as desired; for example, different modes of printing can be used for different colors being applied. For example, a blanket cylinder 3 may have a DiLitho plate applied thereto, and the blanket cylinder 2 a flexo printing plate, each one of the respective cylinders 2, 3 being operated in accordance with the appropriate printing mode.

It is obvious that the system, as described, can also be used with a three-cylinder printing system which, for example, only includes the impression cylinder 1, a blanket cylinder 2, and a plate cylinder 4. Further, of course, it is also possible to apply the invention to a four-cylinder printing system in which the two blanket cylinders 2, 3 are in engagement with each other which apply, respectively, prime and verso printing at the same time.

The type of substrate on which printing is to be effected can be as selected, and the machine is equally applicable for sheet printing or for continuous web printing.

Various changes and modifications may be made within the scope of the inventive concept.

I claim:

1. Multiple printing mode rotary printing machine system for selectively printing in

(a) offset printing mode;

(b) direct lithographic printing mode;

(c) flexographic printing mode, having two side walls (17, 18);

a blanket cylinder (2, 3) located between the side walls;

cylinder means (1) for forming a printing or impression cylinder and defining, with the blanket cylinder,

a printing line;

a plate cylinder (4, 5) located and retained between the side walls adjacent the blanket cylinder (2, 3), said plate cylinder being movable into and out of engagement with the adjacent blanket cylinder;

an inker (9) selectively engageable with the plate cylinder;

and a liquid application system (11)

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wherein, in accordance with the invention,

the liquid application system (11) is a film system having a liquid trough (12), a pickup roller (13) at least in part located in the trough, a liquid transfer roller (14), and a liquid application roller (15);

and first, second and third individual positioning and support means (32, 33; 38; 39) are provided, located on said side walls for selectively positioning and supporting said liquid application system in accordance with a selected mode of printing of the machine, comprising

(a) for offset printing: the first support means (32, 33) being located for, and supporting the liquid application system adjacent to and in liquid transfer contact with said plate cylinder (4, 5) in advance—with respect to the direction of rotation (a) of the plate cylinder—of the inker (9);

and wherein the liquid in the liquid trough comprises damping liquid;

(b) for direct lithographic printing: the second support means (38) being located for and supporting said liquid application system adjacent to and in liquid transfer contact with said blanket cylinder (2, 3) in advance—with respect to the direction of rotation (b) of the blanket cylinder—of said plate cylinder (4, 5);

wherein the liquid in the liquid trough comprises damping liquid; and

wherein said plate cylinder supplies ink to the blanket cylinder from the inker;

(c) for flexo printing: the third support means (39), being located for and supporting said liquid application system adjacent to and in liquid transfer contact with said blanket cylinder (2, 3) in advance—with respect to the direction of rotation (b) of the blanket cylinder—of the printing line and in the zone adjacent the blanket cylinder between the plate cylinder and said printing line;

wherein the liquid in the liquid trough (12) comprises flexo printing ink; and

wherein said plate cylinder is out of contact with the blanket cylinder, the blanket cylinder carries a flexo printing plate.

2. Printing machine system according to claim 1, wherein said first, second and third positioning means comprise rails (32, 33; 38, 39) for selective placement of the liquid application system (11) thereon.

3. Printing machine system according to claim 1, further comprising a carrier structure (16) supporting the liquid application system as a unit;

and an individual drive motor (29) secured to the carrier structure.

4. Printing machine system according to claim 3, where the first, second and third support means (32, 33; 38, 39) comprise rails

and said support structure (16) is secured to said rails.

5. Printing machine system according to claim 3, wherein two plate elements (19, 20) are secured to said support structure (16), extending parallel to the side walls (17, 18) when the liquid application system is located on any one of said positioning and support means;

and wherein the rollers (13, 14, 15) are secured to said parallel plates (19, 20).

6. Printing machine system according to claim 4, further including holding and clamping means (37) for securely attaching and clamping the support structure (16) to the respective rails.

7. Printing machine system according to claim 2, further including position adjustment means (35) secured to said rails for providing an adjustable abutment for the liquid application system (11) on the rails to permit adjustable reproducible positioning of the liquid application system on the rails and for liquid transfer contact of the respective cylinder with the liquid application roller (15) of the liquid application system upon selective placement of the system on any one of said positioning support means.

8. Printing machine system according to claim 4, further including position adjustment means (35) secured to said rails for providing an adjustable abutment for the liquid application system (11) on the rails to permit adjustable reproducible positioning of the liquid application system on the rails and for liquid transfer contact of the respective cylinder with the liquid application roller (15) of the liquid application system upon selective placement of the system on any one of said positioning support means.

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United States Patent [19]

Fischer

[11] **4,423,677**

[45] **Jan. 3, 1984**

[54] **ROTARY SHEET OFFSET PRINTING MACHINE**

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[73] Assignee: **M.A.N.-ROLAND Druckmaschinen Aktiengesellschaft**, Offenbach am Main, Fed. Rep. of Germany

[21] Appl. No.: 353,230

[22] Filed: **Mar. 1, 1982**

[30] **Foreign Application Priority Data**

Mar. 7, 1981 [DE] Fed. Rep. of Germany 3108808

[51] **Int. Cl.**^{3} **B41F 13/24**

[52] **U.S. Cl.** **101/232; 101/184**

[58] **Field of Search** 101/232, 247, 182-185, 101/174-175

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Primary Examiner—E. H. Eickholt

Attorney, Agent, or Firm—Frishauf, Holtz, Goodman & Woodward

[57] **ABSTRACT**

To permit double inking of the blanket cylinder (6, 7; 44, 45) of an offset printing machine, in which all the cylinders are the same, and further to permit retrofitting of an existing printing machine, a control unit (C) is connected to the blanket cylinders which are located in movable bearings to engage or disengage the blanket cylinders, in intermittent movement, from a cooperating impression cylinder (8, 9; 46) when a sheet supply apparatus (3, 41) is commanded to feed a sheet only for every other revolution of the printing system, thereby permitting double inking of the blanket cylinder and preventing contact of the inked blanket cylinder with the impression cylinder when no sheet is being fed thereto.

6 Claims, 4 Drawing Figures

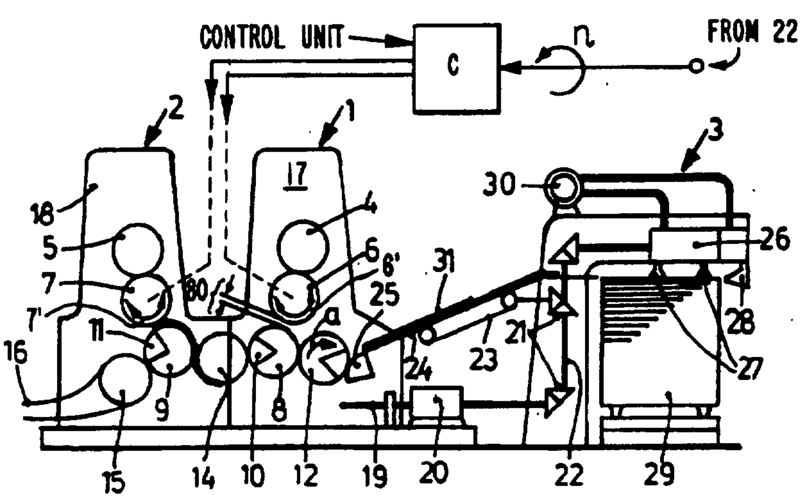

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Fig.1

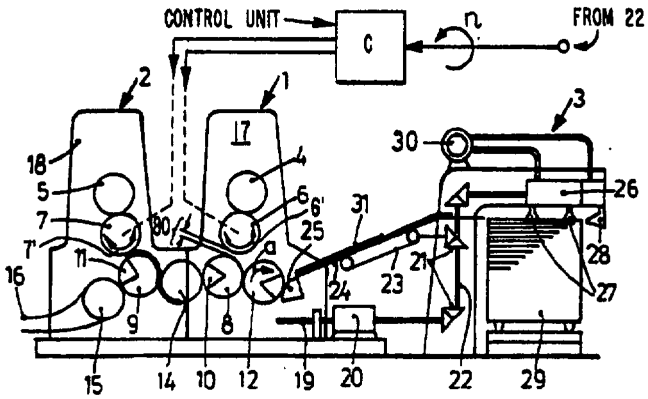


Fig.2

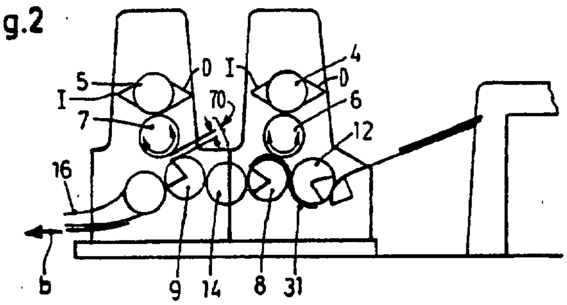


Fig. 3

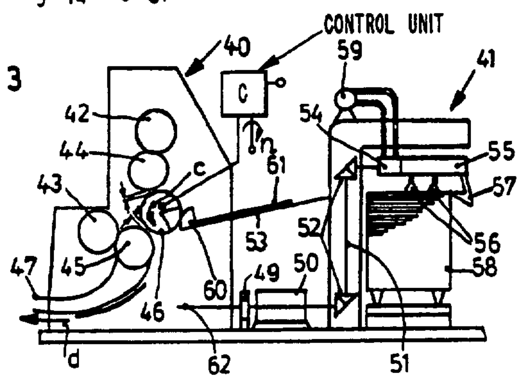
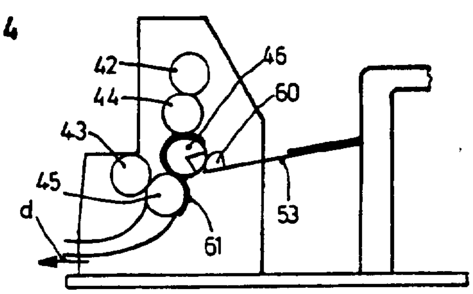


Fig.4



ROTARY SHEET OFFSET PRINTING MACHINE

Cross reference to related applications, assigned to the assignee of this application, the disclosure of which is hereby incorporated by reference:

U.S. Ser. No. 353,229, filed Mar. 1, 1982 now as U.S. Pat. No. 4,409,894 Oct. 18, 1983, FISCHER (claiming priority Fed. Rep. Germany No. P 31 08 806.6); U.S. Ser. No. 353,235, filed Mar. 1, 1982 now U.S. Pat. No. 4,414,896 Nov. 15, 1983, FISCHER (claiming priority Fed. Rep. Germany No. P 31 08 807.4);

The present invention relates to offset printing machines and more particularly to a sheet-fed rotary offset printing machine having a sheet supply apparatus, and which is so arranged that the operating conditions of the machine can be readily matched and headed background. A rotary offset printing machine of the type to which the present invention relates has a plate cylinder and at least one rubber or blanket cylinder, continuously in contact with the plate cylinder and further an impression or printing cylinder; all the cylinders have the same diameter. A printing machine of this type is described, for example, in Walenski, "Einführung in den Offsetdruck", pp. 113, 114 and 137 ("Introduction to Offset Printing"). The blanket cylinder is inked once and provides for printing once for each revolution. Many printing jobs can be carried out by a machine of this type, and satisfactory reproduction of printed subject matter is entirely possible. In some instances, however, inking the rubber cylinder once for each impression is not enough; this may occur when the requirements for printed quality are particularly high and if highly viscous ink is used or the printed substrate, typically paper, has an uneven surface.

It has been proposed, see the aforementioned book, page 113, to utilize a blanket cylinder with an impression cylinder of twice the size and which carries a sheet only about half its circumference, the other half of the circumference being set back with respect to the first half. Thus, for each revolution of the printing cylinder, two revolutions of the associated blanket cylinder will result, causing the blanket cylinder to be inked twice. Based on the construction of the machine, however, double inking will necessarily result at all times, even if the particular printing job would not require double inking as such.

THE INVENTION

It is an object to provide a printing machine in which change-over of single, or double inking of the blanket cylinder can be readily accomplished without changing the size or arrangement of the cylinders of the machine, so that, double or sing inking can be controlled as required. For one mode of operation, double inking can be effected. For normal or ordinary operation, the machine can likewise operate with only a single inking step for each passage of a sheet therethrough.

Briefly, the plate cylinder, the blanket cylinder and the printing or impression cylinder all have the same diameter. The machine is associated with a sheet supply apparatus which can be operated in two speed ranges so that, depending on its adjustment, the cylinders will receive a sheet for each revolution or only for every other revolution; if only half the number of sheets, per unit time, are commanded, that is, for every other revolution, the rubber cylinder and the printing cylinder are separated from each other in such a manner that after a sheet has passed between the blanket cylinder and the associated printed cylinder a subsequent free running or free wheeling revolution or cycle is controlled during which the rubber blanket cylinder and the printing or impression cylinder are separated from each other, to permit inking of the blanket cylinder without an impression being printed, or transferred to a sheet of paper.

DRAWINGS

FIG. 1 is a schematic side view of the printing machine arranged to carry out the different printing operations in accordance with the present invention;

FIG. 2 is a fragmentary view of FIG. 1 in a different operating phase thereof;

FIG. 3 is a second embodiment of a printing machine; and

FIG. 4 is a schematic side view of the machine of FIG. 3 in a different operating phase than that of FIG. 3.

Embodiment of FIGS. 1 and 2: A two color sheet offset rotary printing machine in serial construction is illustrated. The machine has two printing stations **1, 2** and a common sheet supply apparatus **3**. Each one of the printing stations **1, 2** has a plate cylinder **4, 5**, a rubber blanket cylinder **6, 7**, and a printing or impression cylinder **8, 9**. Inkers I and dampers D associated with the plate cylinders and rubber cylinders **6, 7** are shown only schematically in FIG. 2; they have been omitted from the other Figures of the drawings for clarity. They can be of any suitable and well known construction. The printing cylinders **8, 9** have grooves **10, 11** which retain sheet grippers, not shown in detail and which may be of any well known suitable construction. A sheet supply drum **12**, which is also formed with grippers is provided. The printing station **2** includes sprocket wheels **15** which retain a chain conveyor **16** having suitable grippers to transport the printed sheets to a sheet delivery station, not shown and of any suitable and well known construction.

In accordance with the invention, each one of the blanket cylinders **6, 7** is so journaled at the side walls **17, 18** of the printing stations **1, 2** that it can be selectively moved in a curve about the plate cylinders **4, 5** respectively, to assume the positions shown in FIGS. 1 and 2, respectively. Contact with the associated plate cylinders **4, 5** is continuously maintained. Movement of the blanket cylinder **6, 7** in this manner can be readily obtained by journaling the blanket cylinders in bearings which are retained in eccenters positioned in the respective sidewall **17, 18** of the printing stations. Movement of the blanket cylinders, by rotating the eccenters, can be obtained, for example, by hydraulic cylinder-piston arrangements or similar apparatus. The hydraulic positioning piston, or similar apparatus, is operated in timed sequence by an electrical or mechanical control unit C to thereby control the positioning of the respective blanket cylinder **6, 7**. A suitable control unit may, for example, be a timer element providing electrical control pulses to open, or close an electrically controlled valve to admit pressurized hydraulic fluid to a hydraulic positioning piston or to drain hydraulic fluid therefrom; a suitable mechanical control unit may be a pushrod operated by a cam. Positioning devices of this type are known, and were used in the past to control introduction of the first sheet from a stack into the printing machine and subsequently thereto to engage the blanket cylinder with the printing cylinder independent of the feeds to the respective printing line. The present inven-

tion, thus, can use this portion of the existing equipment, modified merely to be able to carry out the additional function required thereof in accordance with the present invention, which will be described in detail below.

The sheet supply apparatus 3 is driven from a main driveshaft 19 of the machine over a two-stage change gear box 20 and a drive train having bevel wheel gearing therein to provide the right-angle drive, as schematically shown at 21. The drive train 22 is coupled to conveyor belt 23 which supplies sheets over a make-ready table 24 to a gripper pickup 25. The drive train 22 further is connected to transmit rotary power to a sheet lifting or pickup device 26 which has longitudinally movable suction cups or suction grippers 27 and separating jet nozzles 28, to pick up the uppermost sheet from a stack of sheets 29 and supply that uppermost sheet to the make-ready table 24. The sheet pickup device 26 not only includes mechanical means to move the suction cups 27 but, additionally, control means which supply the suction grippers 27 with vacuum for suction and the nozzle 28 with compressed air for separation of sheets. Compressed air and suction, that is, the pneumatic system is supplied from a pump 30. The gear box 20 has a selectable transmission ratio of 1:1 and 2:1.

Operation, with reference to FIGS. 1 and 2:

The printing machine is illustrated for operation for double inking of the blanket cylinder 6, 7. FIG. 1 illustrates the machine at the instant of time in which the gripper pickup apparatus 25 picks up a sheet 31. The blanket cylinder 6 is spaced from the associated printing or impression cylinder, as schematically indicated by the spacing lines 18 A sheet has just entered the printing station 2, and is being printed-on by being passed between the blanket cylinder 7 and the printing or impression cylinder 9, which are in engagement with each other.

Upon rotation of the printing machine from the position shown in FIG. 1, in the direction of the arrow a as shown on the sheet supply drum 12, the gripper pickup 25, will after short movement of the sheet 31 forwardly, transfer the sheet to the gripper of the printing cylinder 8. Upon further rotation of the printing cylinder 8 so that the groove 10 (FIG. 1) thereof will reach a tangential position with respect to the blanket cylinder 6, the blanket cylinder 6 is engaged with the printing cylinder 8, so that the sheet 31 will receive the first impression thereon. After rotation of the cylinder 6 for one revolution, starting from the position shown in FIG. 1, that is, by 360°, the various cylinders will have the position shown in FIG. 2. Upon further rotation of the cylinders, the sheet 31 is transferred to the transport drum 14 which supplies the sheet thereafter to the impression cylinder 9. As soon as the trailing end of the sheet 31 has left the niche between the cylinder 6 and 8, blanket cylinder 6 is disengaged from the impression cylinder 8 in order to prevent smearing or soiling of the surface of the impression cylinder 8 during the subsequent idle or free wheeling phase of the blanket cylinder 6. The blanket cylinder 6, however, remains in continuous contact with the plate cylinder 4 so that, during this idle or free wheeling phase, it can receive an inked impression from the plate cylinder 4.

As soon as the leading edge of the sheet 31 has reached the gap between the cylinders 7 and 9, blanket cylinder 7 is engaged with the impression cylinder 9. Subsequently, and during the passage of the sheet between cylinders 7 and 9, the sheet is printed with the second color. When the leading edge of the sheet 31 reaches chain 16, the grippers thereof receive the sheet and carry the sheet off in the direction of the arrow b to a sheet delivery station (not shown). As soon as the trailing end of the sheet 31 has left the impression line between the cylinders 7 and 9, the blanket cylinder 7 is disengaged from the impression cylinder 9, retaining, however, contact with the plate cylinder 5. During the subsequent free wheeling or idling phase of the blanket cylinder 7, which extends for a full revolution thereof, the blanket cylinder receives an additional inking with the second color. The lifted-off condition of the blanket cylinder 7 is shown schematically by the gap 17 in FIG. 2.

Multiple color printing with double-inking results in the decrease in the number of sheets imprinted on per unit time. The number of sheets, which is half with respect to a single-inking printing is obtained by changing the gearing in gear box 20 to a transmission of 2:1 so that, with respect to the revolutions of the cylinders in the printing machine, only half the number of sheets are supplied by the gripper pickup 25 to the machine system, in comparison to the number of sheets for single-inking operation.

Operation of the machine to carry out ordinary, single-sided two-color printing without double inking is known, so that a description thereof is not necessary.

Embodiment of FIGS. 3 and 4:

A sheet offset rotary printing machine having a double printing station 40 and a printing supply device 41 is so constructed that two plate cylinders 42, 43 are in continuous rotary engagement with two blanket cylinders 44, 45, cooperating with a common impression cylinder 46. The blanket cylinders 44, 45 can be moved in position with respect to the impression cylinder 46, by eccentrically located bearings or by pivoting levers. The engagement with the associated plate cylinders 42, 43 is maintained. The two ends of the blanket cylinder 45 have a sprocket wheel attached thereto - not shown in detail, which guides a sheet removal chain 46, supplied with grippers to pick up sheets and transport them to the removal station. The inking systems and damping systems associated with the plate cylinders have not been shown and may be of any suitable construction.

A main drive shaft 62 receives driving power over a belt drive 49 from a motor 50. The main drive shaft 62 is connected to a drive train 51 having bevel gears 52 thereon. The drive train 51, similar to the drive train shown in FIG. 1, has branch gearing arrangements which are used to drive transport belts or conveyors of a make-ready table 53 and additionally are connected to a control unit 54 and a sheet lifting apparatus 55 having suction grippers 56 and compressed air nozzles 57. The sheet lifting or separating device 55 operates the suction grippers 56 such that they pick up the uppermost sheet of a stack of sheets 58 and supply that sheet to the make-ready table 53. Suction and compressed air lines extend from the control unit 54 to a pump 59. The control unit 54 controls supply of suction air as well as of compressed air to the suction grippers 56 and to the nozzle 57, respectively, in such a manner that, upon setting of the printing machine to single inking, the suction grippers are connected upon each movement to the suction source, in order to supply a sheet from the stack 58 to the make-ready table 53.

If double-inking is desired, the control unit 54 so controls suction air and compressed separating air that pneumatic suction and blowing air is supplied only upon each second movement of the lifting device 55. Simi-

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larly, the compressed air nozzle 57 receives compressed air, in clocked sequence, only when the grippers or suction cups 56 are connected to the source of vacuum. Thus, and with reference to machine operating speed, only half the number of sheets is removed from the stack and supplied to the machine than the number which, at the same operating speed of the machine, is supplied to the make-ready table 53 when normal, single-inking is required or commanded. Pickup grippers 60 transfer the sheet from the make-ready table 53 to the printing cylinder 46.

Operation: Starting from the position of the elements shown in FIG. 3, the printing cylinder 46 is moved in the direction of the arrow c. After a short movement, a sheet 61 is supplied by the pickup 60 thereto and transported to the printing line between the blanket cylinder 44 and the printing cylinder 46. The blanket cylinder 44 is engaged with the printing cylinder 46 just before the leading edge of the sheet 61 reaches the printing or contact line. Printing is effected between the cylinders 44 and 46 with the first color.

As the leading edge of the sheet 61 approaches the blanket cylinder 45, blanket cylinder 45 is engaged with the printing cylinder 46. Immediately thereafter, the grippers of the chain 47 grip the sheet which thereby is transferred from the grippers of the printing cylinder 46. During the following phase of sheet movement between the printing cylinder 46 and the blanket cylinder 45, printing is effected by a second color. When the trailing end of the sheet 61 leaves the printing or impression line between cylinders 44 and 46, the blanket cylinder 44 is returned in the position shown in FIG. 3. The blanket cylinder 44 remains in contact with the plate cylinder 42 and thus is inked thereby. Similarly, as soon as the trailing end of the sheet 61 leaves the printing line between the blanket cylinder 45 and the impression cylinder 46, the blanket cylinder 45 is disengaged from the printing cylinder 46 but remains in contact with the plate cylinder 43 so that the blanket cylinder, during the sequence idling revolution, or idling phase, will receive an additional coating of ink. The gaps between the blanket cylinders 44, 45 and the impression cylinder 46 are, respectively, illustrated by the dimension line between the respective cylinders in FIG. 3, unnumbered, however, for clarity of presentation.

Various changes and modifications may be made, and features in connection with one of the embodiments may be used with the other, within the scope of the inventive concept. Thus, a control unit similar to control unit C (FIG. 1) can be used in the embodiment of FIGS. 3 and 4 to effect respective engagement and disengagement of the blanket cylinder 44, 45 with the impression cylinder 46, coupled and synchronized with operation of the pneumatic control unit 54, and hence also synchronized with the rotation of the respective cylinders. Rotary information is entered in the control unit C (FIG. 1) as schematically indicated by the arrow n derived, for example, from a mechanical connection with the drive train 22.

I claim:

1. Rotary sheet offset printing machine having
a sheet supply apparatus (3, 41);
at least one plate cylinder (4, 5; 42, 43);
at least one rubber blanket cylinder (6, 7; 44, 45) associated with the at least one plate cylinder and, during printing, positioned for continuous contact therewith;
means (I) for supplying ink to the at least one plate cylinder;
and a printing, or impression cylinder (8, 9; 46),
said at least one blanket cylinder and said impression cylinder being relatively shiftable with respect to each other for selective printing engagement or for surface separation, respectively;
wherein, in accordance with the invention,
all said cylinders have the same diameter;
said sheet supply apparatus (3, 41) has two different sheet supply rate settings to supply, for one predetermined cylinder speed, in a first supply setting, a predetermined number of sheets per unit time and, for said same predetermined cylinder speed, in a second supply setting, half the number of predetermined sheets per unit time;
and control means (C) are provided, connected to and controlling the relative position of the at least one blanket cylinder (6, 7; 44, 45) and the printing, or impression cylinder (8, 9; 46) such that
(a) when said sheet supply apparatus is in the second supply setting, the blanket and impression cylinders are moved to a separated position during a first revolution of the cylinders to provide for inking of the blanket cylinder, and the blanket cylinder and the impression cylinder are moved to engaged position during a second or subsequent revolution, to permit double inking of the blanket cylinder from the plate cylinder without transfer of printing information from the blanket cylinder after the first inking, and printing on a sheet during said subsequent revolution,

and

(b) when said sheet supply apparatus is in said first supply setting, the blanket and impression cylinders are in continuous printing engagement to provide for single inking of the blanket cylinder and sheet feed at said predetermined number per unit time.

2. Printing machine according to claim 1, wherein said control means (C) moves the blanket cylinder (6, 7; 44, 45) away from the impression cylinder in movement about the circumference of the associated plate cylinder (4, 5; 42, 43).

3. Printing machine according to claim 1, including a main drive shaft (19) connected to drive the sheet supply apparatus (3);
and a two-step gear change box (20) included in the drive shaft having two transmission ratios of 1:1 and 2:1, respectively.

4. Printing machine according to claim 1, wherein said sheet supply apparatus (41) comprises means for lifting and pickup of a sheet including pneumatic means (55) to lift sheets (61) from a stack (58) of sheets;
and the control means controls the pneumatic device for pneumatic suction application, and hence lifting of the sheet, selectively, for each pickup or lifting movement of said sheet supply apparatus or, selectively, for every other sheet pickup or lifting movement thereof.

5. Printing machine according to claim 4, wherein said control means includes a pneumatic control apparatus.

6. Printing machine according to claim 1, wherein a main drive shaft (19, 62) is provided, coupled to a drive train (21, 52) connected to said sheet supply apparatus and to said printing cylinders;
and wherein said control means (C) operates in synchronism with rotation of said drive train.

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United States Patent [19]

Abendroth et al.

[11] **4,446,814**

[45] **May 8, 1984**

[54] **DEVICE FOR APPLYING A FLUID, IN PARTICULAR LACQUERS ON PRINTED SHEETS OR CONTINUOUS WEBS**

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[73] Assignee: **M.A.N. - Roland**, Fed. Rep. of Germany

[21] Appl. No.: **347,144**

[22] Filed: **Feb. 9, 1982**

[30] **Foreign Application Priority Data**

Feb. 12, 1981 [DE] Fed. Rep. of Germany 3105020

[51] Int. Cl.[3] **B05C 1/00**

[52] U.S. Cl. **118/694**; 118/46; 118/262

[58] Field of Search 118/694, 259, 665, 262, 118/46, 210; 101/363

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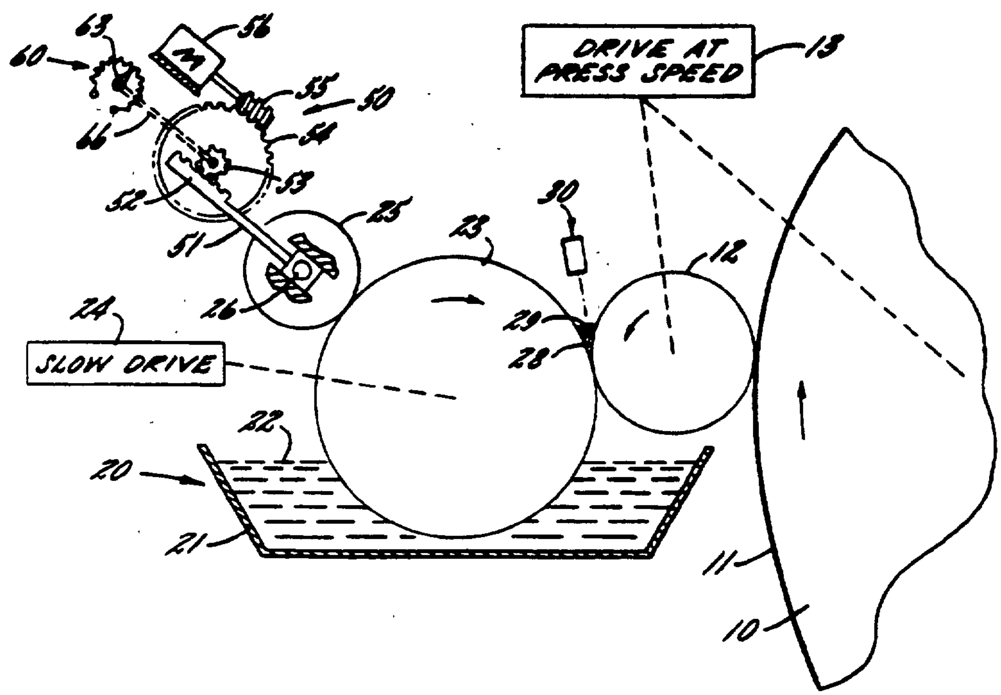
[57] **ABSTRACT**

A device for application of lacquer or the like to a sheet in a printing press. The lacquer is applied by an applicator cylinder having an associated applicator roller. Lacquer is fed from a fountain having a fountain roller which is slowly driven, the lacquer being transferred from the fountain roller to the applicator roller either directly or through intermediate rollers to form a nip in which the lacquer tends to build up. The amount of lacquer transferred by the fountain roller per unit time is determined by a metering roller which engages the fountain roller. A sensing device located at the nip senses the level of lacquer buildup and produces an output signal upon departure of the building from an optimum level. In one embodiment of the invention the output signal is utilized to bring about a corrective adjustment in the position of the metering roller so that the buildup at the nip tends to be restored to optimum level. In another embodiment the output signal sounds an alarm and, if desired, brings the press to a stop so that the situation can be corrected before the applicator cylinder runs dry.

2 Claims, 3 Drawing Figures



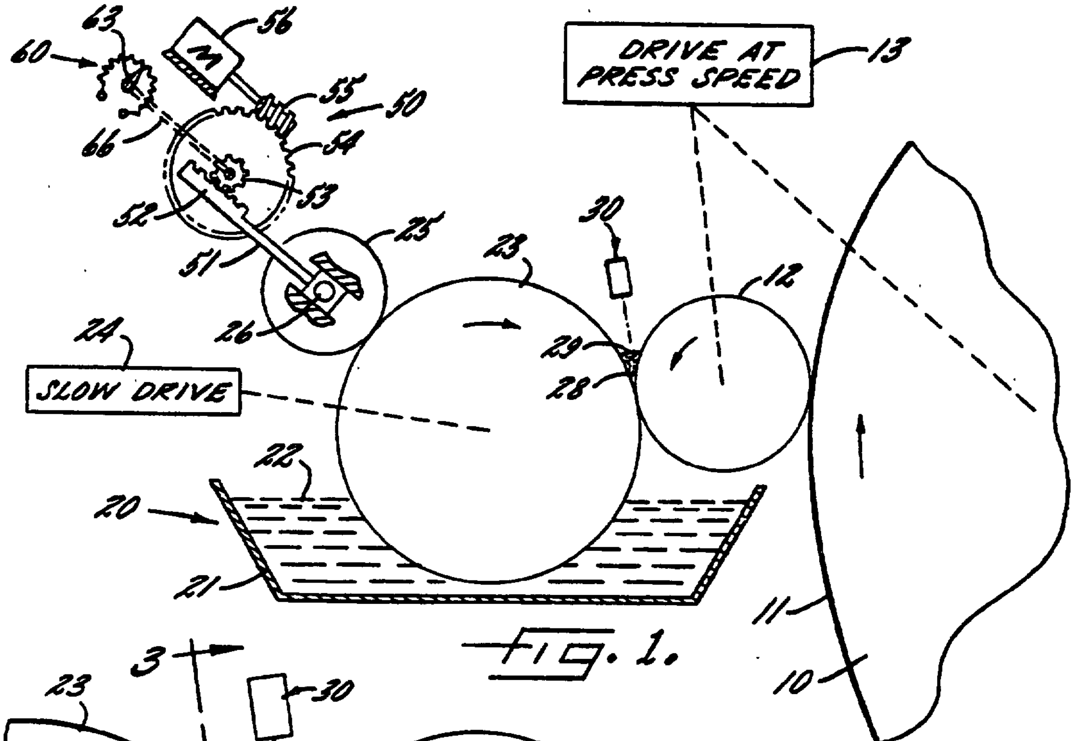


FIG. 1.

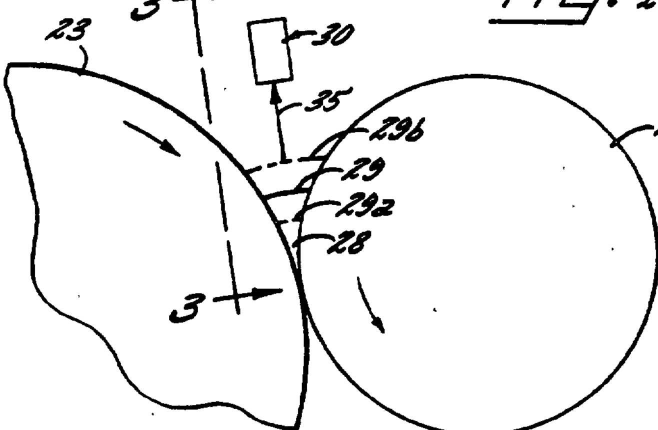


FIG. 2.

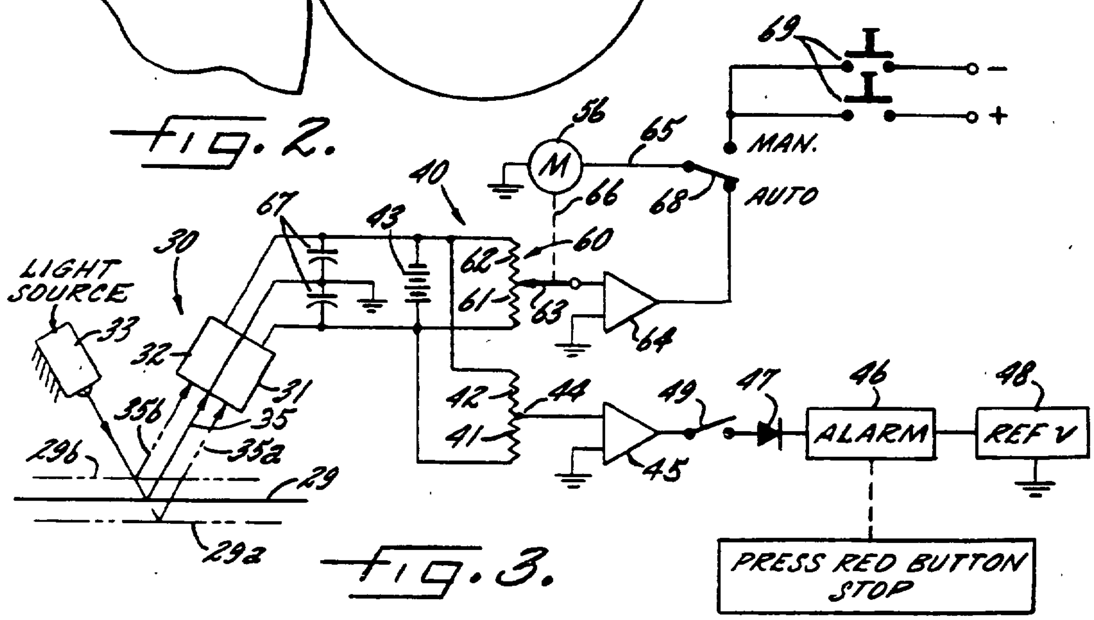


FIG. 3.

DEVICE FOR APPLYING A FLUID, IN PARTICULAR LACQUERS ON PRINTED SHEETS OR CONTINUOUS WEBS

A printing press, in addition to performing its printing function, is often utilized to apply lacquer or other coating material to the sheet. For this purpose an applicator cylinder, having a film of lacquer thereon, engages the face of the sheet as it it supported upon an impression cylinder. For the purpose of furnishing the applicator cylinder with lacquer a "scoop" or fountain roller is partially immersed in a body of lacquer contained in a tray or trough, with the rate of feed being controlled by a metering roller. An applicator roller is interposed between the fountain roller and the applicator cylinder for transfer of the lacquer from the fountain to the cylinder.

The rate of feed of the lacquer must be carefully monitored by the pressman to prevent the applicator cylinder from running dry. Should this occur, the printed material would fail to meet specifications resulting in a loss to the printer.

It is, accordingly, an object of the present invention to provide means including a sensor for monitoring lacquer buildup in a nip in the supply path and for creating an output signal when the buildup departs from an optimum level. It is a related object to provide means responsive to the variation in buildup to produce an output signal which, at the option of the user, (a) sounds an alarm, (b) shuts down the press, or (c) brings about an automatic corrective variation in the rate of feed. It is a more general object of the invention to utilize, as an indicator of feed, the buildup of lacquer or other liquid which occurs at the nip of a pair of counter-rotating rollers in the feed system.

It is another object of the present invention to provide means for monitoring the flow of lacquer or other liquid in a printing press which operates reliably and which is highly economical to install and maintain.

Other objects and advantages of the invention will become apparent upon reading the attached detail description and upon reference to the drawings, in which:

FIG. 1 is a diagram, in elevation, of a lacquer feeding arrangement in a printing press with provision for monitoring the level in a nip and for producing an output signal in accordance with the level of buildup.

FIG. 2 is a fragmentary elevation showing the buildup on an enlarged scale.

FIG. 3, viewed along line 3—3 in FIG. 2, shows a simplified system for detecting the level of buildup and for causing a departure from optimum to (a) sound an alarm, (b) stop the press drive or (c) bring about a corrective change in the rate of feed.

While the invention has been described in connection with certain perferred embodiments, it will be understood that we do not intend to be limited to the embodiments shown but intend, on the contrary, to cover the various alternative forms of the invention included within the spirit and scope of the appended claims.

Turning now to FIG. 1 there is shown an applicator cylinder 10 having a surface 11 which carries a film of lacquer for application to a sheet mounted upon a cooperating impression cylinder (not shown). In rolling engagement with the applicator cylinder is an applicator roller 12, the surfaces of the roller and cylinder being operated at "press speed" by a drive 13

For the purpose of furnishing lacquer to the applicator cylinder, a fountain 20 is provided having a tray or trough 21 containing a body of the lacquer 22. Partially submerged in the lacquer is a fountain roller 23 which is rotated at slow speed by a drive 24. On the "emerging" or left-hand side of the fountain roller 23 is a metering roller 25 having a shaft 26 which is journalled in a bearing 27. Applicator roller 12 and fountain roller 23, rotating in opposite directions, meet at a nip 28. There tends to accumulate, in the nip, a buildup of lacquer indicated at 29, which buildup has an optimum level, indicating an adequate rate of feed, during normal operation. When the buildup exceeds the optimum condition "runover" tends to occur, and when the buildup is less than optimum there is risk that the applicator cylinder 11 will run dry so that the sheets which are produced will be uncoated and therefore unsalable.

In accordance with the present invention a sensing device is located opposite the nip 28 for constantly monitoring the level of buildup and for producing an output signal, utilized by the pressman, when the buildup departs from optimum. The sensing device, indicated at 30, may take various forms without departing from the invention. For example, the sensing device may be of the optical type as illustrated in FIG. 3 consisting of adjacent photocells 31, 32 illuminated by a light source 33. The light source produces a beam 34 which is specularly reflected from the surface of the buildup along path 35. When the level of buildup 29 is optimum, the light reflected into the photocells 31, 32 will be equal and no output signal will be produced. The level of buildup may fall to the level 29*a* which causes the reflective path to switch to position 35*a* which favors the photocell 31. Such condition produces an output signal for the sounding of an alarm or the like. Alternatively, the buildup may rise to the level 29*b* resulting in a reflection path 35*b* which favors the photocell 32. This also produces an output signal which results in corrective action being taken.

In carrying out the invention a bridge circuit is provided for responding to unbalance between the two photocells and for producing an output signal in accordance therewith. This bridge circuit, indicated at 40, has the photocells 31, 32 in its first two legs and resistors 41, 42 in third and fourth legs, respectively. The bridge is energized by a battery 43. Thus, under conditions of unbalance an output signal exists at output terminal 44. The output voltage is amplified by an amplifier 45, the output of which energizes an alarm device 46. An interposed diode 47 ensures that the alarm is sounded only in response to a falling level. The point of triggering of the alarm is determined by including, in series, an adjustable source of reference voltage 48. The alarm circuit is turned on by a switch 49.

In operation, and with the bridge initially balanced, the level is at 29 and there is a complete absence of output signal. However, if for any reason the level at the nip should fall, say to the level 29*a*, the photocell 31 is favored as compared to the photocell 32 resulting in an output signal at output terminal 44 which, amplified by amplifier 45 and with favorable polarization at diode 47, the alarm 46 sounds alerting the pressman to check both the rate of feed in the system and the level of the body of lacquer in the tray 21.

If desired, the alarm device 46 may be coupled to the dropout circuit of the press drive 13, as shown in FIG. 3, in such a way that the alarm condition is effective to trigger a "red button stop", bringing the press quickly

to a halt and signifying that corrective action should be urgently taken.

In accordance with one of the aspects of the present invention the output signal from the bridge circuit 40 may be utilized to bring about a corrective change in the rate of feeding of the lacquer by the fountain roller 23. This is brought about by an electro-mechanical servo system 50, the mechanical portion of which is set forth in FIG. 1. Thus, the bearing 27 which supports the shaft of the metering roller 25 is slidably mounted in ways formed in the frame of the machine and positioned by a plunger 51. The plunger 51 is connected to a rack 52 which is driven by a pinion 53 coupled to a gear 54. The latter is rotatable by a worm 55 driven by a reversable motor 56. All that need be said about the motor is that it is capable of driving in opposite directions depending on the polarity of the control signal.

To produce an output signal the bridge 40 is terminated in a potentiometer 60 having legs 61, 62 and a wiper 63. The wiper is connected to the input of an amplifier 64 having an output lead 65 which drives the motor 56. The mechanical output of the motor is coupled by a connection 66 (see also FIG. 1) to the wiper 63 of the potentiometer. Capacitors 67 respectively connected across the photocells 31, 32 have an averaging effect and make the system nonresponsive to transient changes in level and, more particularly, to transient departures from the horizontal.

The servo system is turned on by a switch 68 which is capable, also, of switching push-buttons 69 into the circuit for manual control.

It will be assumed that initially the buildup is horizontal and at the level indicated at 29. It will further be assumed that the bridge, under such conditions, is balanced so that the motor 56 is de-energized. Upon a drop in the level of buildup from 29 to 29*a*, the reflected beam switches to position 35*a* causing more of the reflected light to enter photocell 31 than enters photocell 32. This unbalances the bridge causing an output signal to exist at the bridge terminal 63, which signal is fed to the amplifier 64. The amplified signal is applied, by line 65, to the motor 56 causing the motor to rotate in the direction which produces backing off of the plunger 51 thereby creating additional clearance between the fountain roller 23 and the metering roller 25 allowing lacquer to be transported at a greater rate to the nip 28. At the same time the motor, through connection 66, causes movement of the slider 63 on potentiometer 60 to rebalance the bridge circuit so that the signal fed through the amplifier 64 to the motor 56 is reduced to zero, turning off the motor.

The increased rate of flow of the lacquer causes the buildup to be restored from the low level 29*a* to the optimum level 29. Any tendency of the level to exceed the level 29, causing a rise in the level of buildup to the level 29*b*, results in a switch of the reflected beam to the path 35*b* which causes more light to be transmitted to photocell 32 than is transmitted to photocell 31. This results in an output signal at output terminal 63 of the bridge which is opposite to that previously produced and which, amplified by the amplifier 64, causes the motor 56 to rotate in the opposite direction, that it, in a direction to slightly close down the metering roller 25 reducing the flow of lacquer to the nip 28 and, simultaneously, through connection 66, rebalancing the bridge so that the level of buildup does not substantially exceed the level 29. This constitutes a "hunting" type of control in which the level of buildup swings slightly above and slightly below the optimum level 29 so that the flow of lacquer to the applicator roller and applicator cylinder is, on the average, at an optimum rate.

While the invention has been described in connection with a sensor 30 which works on an optical, or reflective, principle, it will be apparent to one skilled in the art that the invention is not limited thereto and that other sensors 30, arranged opposite the nip 28 for response thereto and capable of producing an output signal which varies in accordance with a departure in buildup from the optimum level, may be substituted without departing from the present invention.

In the arrangement described it is preferable for the fountain, or scoop, roller 23 and the applicator cylinder 11 to be hard surfaced while the applicator roller 12 and metering roller 25 are resiliently surfaced.

Although the invention has been described in connection with a highly simplified arrangement in which there is direct transfer of lacquer from the fountain, or scoop, roller 23 to the counter-rotating applicator roller 12, to produce the buildup 29, it will be understood that the invention is not limited to such simplified form and, if desired, additional roller may be interposed between the fountain roller and applicator roller and driven at a surface speed corresponding to one of them, for creation of a nip having a region of buildup which is monitored by a sensing device 30 as described.

The term "signalling means" as used herein refers to any means capable of attracting the attention of the pressman or for bringing about a corrective change in the rate of feed.

We claim:

1. In a printing press the combination comprising an applicator cylinder for receiving a film of lacquer from an associated counterrotating applicator roller, means for driving the cylinder and applicator roller at press speed, a fountain supplying the lacquer and having a fountain roller partially immersed in a reservoir of lacquer disposed below said fountain roller, means for driving the fountain roller so that it picks up a coating of lacquer from said reservoir, said fountain roller engaging the applicator roller so that some of the lacquer is transferred from the fountain roller to the applicator roller, a metering roller engaging the fountain roller, means for adjusting the transaxial spacing between the metering roller and the fountain roller so that a film of regulated thickness is applied to and transferred by the applicator roller, said fountain roller driving means being operable to drive said fountain roller in a counterrotative direction with respect to the applicator roller with the contacting applicator roller and cylinder surfaces being rotated upwardly at the nip between the applicator roller and the cylinder so that there is no significant buildup of lacquer at the nip between the applicator roller and the cylinder and with the contacting fountain roller and applicator roller surfaces being rotated downward at the nip between the fountain roller and the applicator roller so that the lacquer tends to buildup at the nip between the fountain roller and the applicator roller, the engagement of the fountain roller and the applicator roller causing a desired thickness of lacquer to be transferred to the cylinder when the buildup of lacquer is at an optimum level in the nip between the fountain roller and applicator roller, means including a sensing device located at the nip between the fountain roller and applicator roller for sensing said buildup of lacquer and for producing an output signal upon departure of the buildup from an optimum level,

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and means responsive to an input signal from the sensing device for acting upon the adjusting means to bring about a corrective adjustment in the position of the metering roller with respect to the fountain roller so that said lacquer buildup in the nip tends to be restored to the optimum level.

2. The combination as claimed in claim 1 further comprising means responsive to the sensing device for emitting a warning signal when the fluid buildup drops substantially below the optimum level.

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United States Patent [19]

Frank et al.

[11] **4,451,509**

[45] **May 29, 1984**

[54] **RADIATION-HARDENABLE AQUEOUS BINDER EMULSIONS OF ACRYLATE PREPOLYMER WITH UNSATURATED POLYESTER EMULSIFIER HAVING BENZYLOXY AND ALKYLENE-OXY GROUPS**

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[58] **Field of Search** 427/54.1; 428/425.1, 428/159.16; 204/159.15, 159.19, 159.23

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[57] **ABSTRACT**

This invention relates to aqueous, radiation-hardenable emulsions produced from mixtures of the following:

(A) from 90 to 50%, by weight, of at least one acrylate prepolymer, containing, per 100 g, from 0.2 to 0.65 mols of (meth)acryloyloxy groups and having a viscosity of from 500 to 300,000 mPa.s, measured at 20° C.;

(B) from 10 to 50%, by weight, of at least one emulsifier polyester having a viscosity of from 2,000 to 200,000 mPa.s, containing, per 100 g:

(1) from 0.06 to 0.28 mols of condensed units of an α-β-mono-olefinically unsaturated dicarboxylic acid;

(2) from 0.04 to 0.34 mols of benzyloxy groups; and

(3) from 30 to 80%, by weight, based on emulsifier polyester, of alkylene-oxy groups (-alkylene-O-);

the sum of (A) and (B) amounting to 100%,

(C) from 25 to 400%, by weight, of water; and

(D) from 0 to 10%, by weight, of at least one conventional photoinitiator;

the percentage contents of (C) and (D) being based on the sum of (A) and (B). The emulsions are used in particular for coating wood and wood-like materials.

4 Claims, No Drawings

RADIATION-HARDENABLE AQUEOUS BINDER EMULSIONS OF ACRYLATE PREPOLYMER WITH UNSATURATED POLYESTER EMULSIFIER HAVING BENZYLOXY AND ALKYLENE-OXY GROUPS

This invention relates to radiation-hardenable, aqueous binder emulsions based on a mixture of radiation-hardenable prepolymers containing (meth)acryloyloxy groups, and radiation-hardenable, copolymerisable, unsaturated polyesters as emulsifiers which may be incorporated in the copolymer. The emulsions are preferably used for coating wood and wood-like materials, for example veneer-imitation films.

A large number of aqueous dispersions based on (meth)acrylate prepolymers of a different composition are known. Anionic aqueous dispersions are mainly described, which are obtained by the neutralisation of prepolymers containing carboxyl groups, possibly with the addition of a solvent (see Lackkunstharze, H. Wagner and H. F. Sarx, Carl Hanser Verlag 1971, P. 235). Dispersions of this type have the disadvantage that the neutralising agents, such as alkalis and amines, accelerate the saponification of the condensed binders containing ester groups. Furthermore, the neutralising agents remain to some extent in the lacquer film and, consequently, the water resistance of the film decreases and the amine residues may cause a yellowing effect. The proportion of solvent which may be present is detrimental to the environment during the drying process.

German Offenlegungsschrift No. 2,853,921 (=U.S. Pat. No. 4,287,039) discloses the production of radiation-hardenable, aqueous binder dispersions based on prepolymers containing C-C double bonds, in which polyvinyl alcohol and/or vinyl pyrrolidone-vinyl ester copolymers, always having residual contents of vinyl acetate or vinyl esters are used as the dispersing agent. The aqueous dispersions are produced in the presence of solvents. A disadvantage of this process is the considerable expense of dispersion due to distilling off the solvent after dispersing. Furthermore, due to the high molecular weight of these dispersing agents, they tend to form films and "stalactites" when the dispersion is applied to points of the application machines which are particularly exposed due to a draught. They may only be re-solubilized with very great difficulty and often obstruct the application until it has to be discontinued.

German Offenlegungsschrift No. 2,936,039 (=U.S. patent application Ser. No. 183,076, filed Sept. 2, 1980, now U.S. Pat. No. 4,339,566, relates to radiation-hardenable, aqueous dispersions based on urethane acrylates which contain incorporated sulphonic acid groups, thus allowing dispersion in water. However, for easier handling, the dispersions are prepared in the presence of up to 30%, by weight, based on urethane acrylate, of solvents which should be removed before hardening. In the case of higher contents of sulphonic acid groups in the hardened products, the water-sensitivity is also increased. Due to the relatively high viscosity of the dispersions, they are only suitable to a limited extent for the casting apparatus used for coating wood.

Furthermore, aqueous emulsions of mixtures of unsaturated polyesters are known from German Offenlegungsschrift No. 2,804,216 (=U.S. Pat. No. 4,281,068), which are used as air-drying coating agents for wood and wood-like materials. At least one of the unsaturated polyesters is used as an emulsifying agent which may be incorporated. It contains condensed therein alkylene-oxy radicals (-alkylene-O-) and allyloxy groups. Emulsifier polyesters of this type are unsuitable for emulsifying prepolymers containing (meth)acryloyloxy groups, because after a short time, they cause, inter alia, gelatinisation of the mixture.

An object of the present invention is to provide aqueous, radiation-hardenable binder emulsions which are free from reactive diluents and are based on prepolymers having (meth)acryloyloxy groups and which obtain a stable oil-in-water structure due to the emulsifier, as a result of which, they may also be applied using casting machines which are conventional for coating furniture, and in which the emulsifier is incorporated in the polymer by copolymerisation during radiation hardening.

This object is achieved by using non-ionically active emulsifier polyesters to emulsify the prepolymers containing (meth)acryloyloxy groups (=acrylate prepolymers), which polyesters copolymerise with the acrylate prepolymer via incorporated units of α-β-mono-olefinically unsaturated dicarboxylic acids, and the polyol moiety of which contains alkyleneoxy-(-alkylene-O-) and benzyloxy groups.

Thus, the present invention provides aqueous radiation-hardenable emulsions produced from mixtures of the following:

(A) from 90 to 50%, by weight, preferably from 90 to 70%, by weight, of at least one acrylate prepolymer, containing, per 100 g, from 0.2 to 0.65 mols, preferably from 0.3 to 0.55 mols, of (meth)acryloyloxy groups and having a viscosity of from 500 to 300,000 mPas, preferably from 1000 to 100,000 mPas, measured at 20° C.,

(B) from 10 to 50%, by weight, preferably from 10 to 30%, by weight, of at least one emulsifier polyester having a viscosity of from 2,000 to 200,000 mPas, preferably from 10,000 to 50,000 mPas, measured at 20° C., and containing, per 100 g:
  (1) from 0.06 to 0.28 mols, preferably from 0.1 to 0.23 mols, of condensed units of an α-β-mono-olefinically unsaturated dicarboxylic acid;
  (2) from 0.04 to 0.34 mols, preferably from 0.1 to 0.2 mols, of benzyloxy groups; and
  (3) from 30 to 80%, by weight, preferably from 40 to 78%, by weight, based on the emulsifier polyester, of alkyleneoxy groups (-alkylene-O-);

the sum of (A) and (B) amounting to 100%;

(C) from 25 to 400%, by weight, preferably from 40 to 300%, by weight, of water; and

(D) from 0 to 10%, by weight, preferably from 0 to 5%, by weight, of at least one conventional photoinitiator;

the percentage contents of (C) and (D), respectively, being based on the sum of (A) and (B).

The present emulsions are free of solvent and monomers. The term "free of monomers" means that the emulsions are free of monomers which may be copolymerised with components (A) and (B).

Acrylate prepolymers (A) within the context of the present invention are prepolymers which contain at least two (meth)acryloyloxy groups and which are derived from polyesters, polyethers, polyether polyesters, polyepoxides, aliphatic polyols, polyurethanes and vinyl polymers. Acrylate prepolymers of this type are known and are described, for example in U.S. Pat. Nos. 2,101,107; 2,413,973; 2,951,758; 3,066,112; 3,301,743; 3,368,900; 3,380,831; 3,455,801; 3,469,982; 3,485,732;

3,530,100; 3,551,246; 3,552,986; 3,628,963; 3,660,145; 3,664,861; 3,689,310; 3,719,521; 3,732,107; 3,782,961; 3,840,369; 3,888,830; 4,033,920; and 4,206,025; British Pat. Nos. 1,006,587; 1,241,823; 1,241,824; and 1,321,372 and in German Offenlegungsschrift Nos. 1,916,499 and 2,853,921.

Polyester acrylates and polyurethane acrylates are preferred acrylate prepolymers.

The following are particularly preferred polyester acrylates: polyesters containing (meth)acryloyloxy groups obtained from aliphatic dicarboxylic acids having from 4 to 10 carbon atoms and/or cycloaliphatic dicarboxylic acids having from 8 to 11 carbon atoms and/or aromatic dicarboxylic acids having from 8 to 10 carbon atoms, such as adipic acid, succinic acid, sebacic acid, hexahydrophthalic acid, terephthalic acid, o-, m-, p-benzene dicarboxylic acid, maleic acid, fumaric acid or derivatives thereof (for example anhydrides) and polyhydric aliphatic alcohols having from 2 to 6 carbon atoms and/or polyhydric aliphatic ether alcohols having from 4 to 16 carbon atoms, such as ethylene glycol, diethylene glycol, triethylene glycol, propane diols, dipropylene glycol, butane diols, hexane diol-1,6, neopentyl glycol, trimethylol propane, oxethylated trimethylol propane (having on average from 3 to 5 ethylene oxide units), pentaerythritol, oxethylated pentaerythritol and dipentaerythritol. The polyester acrylates are produced by conventional processes in one or more steps.

The following are particularly preferred polyurethane acrylates: polyaddition products from ω-hydroxyalkyl(meth)acrylates having from 2 to 4 carbon atoms in the hydroxyalkyl radical, in particular β-hydroxyethyl(meth)acrylate, and aliphatic and/or cycloaliphatic and/or aromatic polyisocyanates, such as hexamethylene, isophorone, dicyclohexylmethane, diphenylmethane and toluylene diisocyanates, in particular hexamethylene diisocyanate and isophorone diisocyanate. The polyisocyanates are prepolymers containing in particular isocyanate groups (=urethane polyisocyanates) from the previously-mentioned diisocyanates which are used in excess and the polyhydric aliphatic alcohols and/or polyhydric aliphatic ether alcohols, as they are described above for the polyester acrylates. The urethane polyisocyanates may be produced, for example, according to U.S. Pat. No. 3,183,112.

The polyisocyanates which are used for polyaddition with the α-hydroxy alkyl(meth)acrylates may also contain isocyanurate groups or biuret groups. They are derived in particular from hexamethylene diisocyanate or isophorone diisocyanate and may be obtained according to U.S. Pat. Nos. 3,919,218 or 3,124,605.

The α-β-mono-olefinically unsaturated emulsifier polyesters (B) are polycondensation products of at least one α-β-mono-olefinically unsaturated dicarboxylic acid usually having 4 or 5 carbon atoms, or ester-forming derivatives thereof (for example anhydrides), optionally in admixture with up to 100 mol %, based on the unsaturated acid component, of at least one aliphatic saturated dicarboxylic acid having from 4 to 10 carbon atoms or a cycloaliphatic or aromatic dicarboxylic acid having from 8 to 10 carbon atoms or ester-forming derivatives thereof (for example anhydrides), with at least one aliphatic dihydric polyether alcohol, optionally in admixture with at least one aliphatic trihydric polyether alcohol (up to 50 mol %, based on diol), and with at least one aliphatic polyhydric alcohol having n hydroxy groups (n=3 or 4, preferably 3), of which at least one and at most n-1 hydroxy groups are etherified with benzyl alcohol.

α-β-mono-olefinically unsaturated dicarboxylic acids preferably include maleic acid, fumaric acid and itaconic acid. The following are mentioned as examples of aliphatic saturated dicarboxylic acids: succinic acid, adipic acid and subacic acid. The following are included as examples of cycloaliphatic and aromatic dicarboxylic acids: hexahydrophthalic acid, methyl hexahydrophthalic acid, tetrahydrophthalic acid, methyl tetrahydrophthalic acid, endomethylene tetrahydrophthalic acid, o-phthalic acid, isophthalic acid and terephthalic acid

Polyalkylene glycols having from 2 to 4 carbon atoms in the alkylene moiety are preferred aliphatic dihydric polyether alcohols and, when trimethylene-oxy and/or butylene-oxy groups are present in the polyalkylene glycol, at least 50 mol % of ethylene-oxy groups, based on the total of mols of alkylene-oxy groups, should always be present. Polyethylene glycols are particularly preferred. The aliphatic trihydric polyether alcohols are preferably derived from trimethylolpropane and are preferably obtained in a known manner by oxalkylation with ethylene oxide. Examples of polyhydric alcohols containing benzyloxy groups include the following: trimethylolpropane monobenzyl ether, trimethylolpropane dibenzyl ether, pentaerythritol monobenzyl ether, pentaerythritol dibenzyl ether and pentaerythritol tribenzyl ether.

The emulsifier polyesters may be produced by known processes in one or more steps.

The acid number of the emulsifier polyesters (B) should generally be from 1 to 50, preferably from 5 to 40, mg/KOH per g of substance, and the OH numbers should generally be from 10 to 100, preferably from 10 to 80, mg/KOH per g or substance, and the molecular weights determined as a numerical average should be from 300 to 5000, preferably from 500 to 2000.

In order to protect the present coating agents from an undesirable premature polymerisation, it is advisable to add from 0.001 to 0.1%, by weight, of polymerisation inhibitors or antioxidants during the production of the acrylate prepolymers and the emulsifier polyesters. Suitable stabilizers are described in "Methoden der organischen Chemie" (Houben-Weyl), 4th edition, volume XIV/I, P. 433–452, 756; Georg-Thieme-Verlag, Stuttgart, 1961. For example, p-benzoquinone is particularly suitable in a concentration of from 0.01 to 0.05%, by weight, based on the total of the acrylate prepolymer and emulsifier polyester.

Suitable photoinitiators are described in the monograph by J. Kosar, Light-Sensitive Systems, J. Wiley & Sons, New York-London-Sydney, 1965.

Photoinitiators (D) which are preferred are the compounds which are usually used, for example, benzophenone, and very generally aromatic keto compounds which are derived from benzophenone, such as alkyl benzophenones, halo-methylated benzophenones according to German Offenlegungsschrift No. 1,949,010 (U.S. Pat. No. 3,686,084), anthrone, halogenated benzophenones optionally together with tertiary aliphatic amines and Michler's ketone. Anthraquinone and numerous derivatives thereof, for example β-methylanthraquinone, t-butylanthraquinone and anthraquinone carboxylic acid ester, also oxime esters according to German Offenlegungsschrift No. 1,795,089 are equally effective photoinitiators.

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Benzoin and derivatives thereof are particularly preferred photoinitiators (see German Auslegeschrift No. 1,694,149, and German Offenlegungsschrift Nos. 1,769,168; 1,769,853; 1,769,854; 1,807,297 (U.S. Pat. No. 3,636,026); 1,807,301 (U.S. Pat. No. 3,824,284); and 1,919,678 (U.S. Pat. No. 3,732,273)).

The following are included as photoinitiators which are also particularly preferred: for example benzil ketals, such as benzil dimethyl ketal and hydroxy alkyl phenones, for example 2-hydroxy-2-methyl-1-phenyl-propan-1-one.

The emulsions according to the present invention may be produced by stirring the water (C) into the mixture of (A)+(B), for example by simply stirring or by means of dissolvers.

In order to produce a finely-divided emulsion, i.e. to increase the effect of the shearing forces, it is advantageous to add water in portions at a temperature below 30° C. When there is optimum shearing, oil-in-water emulsions are formed.

The photoinitiator (D) may be added to the mixture of (A)+(B) before emulsifying or, if there is adequate water solubility, may be added to the emulsion.

In order to protect photosensitive substrates for example light-coloured woods, small quantities of conventional UV absorbers may be added to the coating compositions, for example 2-hydroxy-4-methoxy-benzophenone, or cinnamic acid and benzotriazine derivatives which are conventionally used, may be added.

Conventional additives and dyes, preservation, matting and flow agents and pigments may also be added to achieve particular effects, as long as they do not fundamentally influence the emulsion stability and the polymerisation.

The emulsions according to the present invention are outstandingly suitable for processing on conventional lacquering apparatus which are equipped with casting machines. Furthermore, they may be applied by rolling and spraying. Wood and wood-like products, for example veneer-imitation films are preferred substrates.

Hardening is effected using ionising, for example high-energy electron radiation or, in the presence of photoinitiators, UV radiation, advantageously only after the lacquer film has released water. The film is usually formed over a short period of time, without heat having to be supplied, by the release of water, in layer thicknesses which are conventional for lacquers (from 10 to 200 μm dry layer thickness). If required, the film may also be formed at a temperature of up to 100° C.

The following Examples illustrate the present invention. The percentages are based on weight. The viscosity was measured in a Höppler falling ball viscosimeter (DIN 53 015) at 20° C.

Production of the starting materials

Acrylate prepolymer A1

91 g of adipic acid, 55 g of phthalic acid anhydride, 100 g of trimethylolpropane, 62 g of ethylene glycol and 66 g of 2-ethyl caproic acid are esterified in a melt condensation at 190° C. under an inert gas atmosphere, until the acid number (AN) is below 10. This number was 7.4 and the OH number was 300 mg KOH/g of substance. After adding 86 g of acrylic acid, 0.25 g of hydroquinone, 3 g of p-toluene sulphonic acid and 175 g of toluene, the mixture is further esterified azeotropically at from 100° to 120° C. while passing air through. After distilling off the toluene under vacuum, the prepolymer has a viscosity of 18,500 mPa.s. The AN is 8 and the OH number is 80 mg KOH/g of substance.

Acrylate prepolymer A2

An OH group-containing partial ester which also contains acryloyloxy groups is first of all produced by azeotropically esterifying an oxethylated trimethylolpropane [OH number 550 (mg KOH/g of substance), degree of oxethylation about 4] with acrylic acid.

925 g of oxethylated trimethylolpropane are heated to reflux with 430 g of acrylic acid, 12 g of p-toluene sulphonic acid, 1 g of p-methoxy-phenol, 1.2 g of di-t-butyl-hydroquinone and 280 g of toluene while passing air through, and the water produced by the reaction is removed azeotropically. After reaching an acid number below 3 (mg KOH/g of substance), the solvent is removed under vacuum and the product is subjected to clearing filtration. An ethylenically unsaturated partial ester containing OH groups is obtained which has the following characteristic data:

Iodine colour number: 0-1
Acid number: 2
OH number: 115

The partial ester containing acryloyloxy groups which is obtained above is then reacted with 2,4-toluylene diisocyanate to produce the acrylate prepolymer A2.

174 g of 2,4-toluylene diisocyanate and 0.7 g of p-methoxy-phenol are introduced into a stirrer-equipped apparatus, with dry air being passed over, and are heated to from 40° to 65° C.

980 g of the partial ester containing OH groups and acryloyloxy groups are added over a period of about 2 hours and the mixture is stirred at the specified temperature until the NCO value amounts to less than 0.1%.

The viscosity of the acrylate prepolymer A2 is 46,000 mPa.s.

Emulsifier polyester B1

199 g of maleic acid anhydride, 609 g of polyethylene glycol (MW 400) and 228 g of trimethylolpropane monobenzyl ether are subjected to melt condensation at 190° C. under a stream of N_2. Acid number 8, OH number 63. Viscosity 40,000 mPa.s.

Emulsifier polyester B2

175 g of maleic acid anhydride, 643 g of polyethylene glycol (MW 400) and 214 g of trimethylolpropane dibenzyl ether are condensed as described under B1 to an acid number of 7. The OH number is 36 and the viscosity is 20,500 mPa.s.

EXAMPLES

To produce the emulsions of the present invention, 200 g each of acrylate prepolymer A1 and A2 are mixed with 50 g of emulsifier polyester B1 and B2, respectively, and with each 5 g of photoinitiator benzyl dimethyl ketal, sheared with in each case 110 g of water in the dissolver at 8000 r.p.m., and then adjusted with water to 50% solids content with stirring (1,000 r.p.m.). Oil-in-water emulsions are produced.

Example	1	2
Acrylate prepolymer	A1	A2
Emulsifier polyester	B1	B2
Viscosity mPas	55	68

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-continued

Example	1	2
Particle size nm	300-600	250-500

The emulsions may be cast on the casting machines which are conventional for coating wood, without fault and without the formation of a skin or "stalactites" at the points which are particularly exposed to a draught, such as the storage container and casting lips. An application of 70 g/m^2 hardens under IST radiators (pulse radiators manufactured by Strahlentechnik Hildebrand, Werner and Pfleiderer, 80 watts/cm radiator length, distance 20 cm) at 8 m/min processing rate to produce perfectly waterproof lacquer films.

We claim:

1. An aqueous radiation-hardenable emulsion which comprises:
(A) from 90 to 50%, by weight, of at least one acrylate prepolymer containing, per 100 g, from 0.2 to 0.65 mols of (meth)acryloyloxy groups and having a viscosity (20° C.) of from 500 to 300,000 mPas;
(B) from 10 to 50%, by weight, of at least one emulsifier polyester having a viscosity (20° C.) of from 2000 to 200,000 mPas and containing, per 100 g:
(1) from 0.06 to 0.28 mols of condensed units of at least one α,β-mono-olefinically unsaturated dicarboxylic acid;
(2) from 0.04 to 0.34 mols of benzyloxy groups; and
(3) from 30 to 80%, by weight, based on (B), of alkylene-oxy groups;
the sum of (A) and (B) amounting to 100%;
(C) from 25 to 400%, by weight, of water; and
(D) from 0 to 10%, by weight, of at least one photoinitiator;
the contents of (C) and (D) being based on the sum of (A) and (B).

2. An emulsion as claimed in claim 1 comprising:
(A) from 90 to 70%, by weight, of at least one acrylate prepolymer containing, per 100 g, from 0.3 to 0.55 mols of (meth)acryloyloxy groups and having a viscosity (20° C.) of from 1000 to 100,000 mPas;
(B) from 10 to 30%, by weight, of at least one emulsifier polyester having a viscosity (20° C.) of from 10,000 to 50,000 mPas and containing, per 100 g;
(1) from 0.1 to 0.23 mols of condensed units of at least one α,β-mono-olefinically unsaturated dicarboxylic acid;
(2) from 0.1 to 0.2 mols of benzyloxy groups; and
(3) from 40 to 78%, by weight, of alkylene-oxy groups;
(C) from 40 to 300%, by weight, of water; and
(D) from 0 to 5%, by weight, of at least one photoinitiator.

3. A process for the production of a coating on a substrate which comprises applying an emulsion as claimed in claim 1 to a substrate and hardening the the emulsion by the action of radiation.

4. A process as claimed in claim 3 in which the substrate is wood or a veneer-imitation film.

* * * * *

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United States Patent [19]

Matsuno et al.

[11] **Patent Number: 4,501,223**

[45] **Date of Patent: Feb. 26, 1985**

[54] **COATING APPARATUS**

[75] Inventors: **Sadayuki Matsuno**, Yokohama; **Hiroshi Itoh**, Tokyo; **Isamu Nishikawa**, Yokohama; **Tatsuo Awazu**, Zushi; **Toshio Matsunaga**, Tokyo; **Yoshitaka Kitaoka**; **Goro Sugimoto**, both of Yokohama; **Hiroki Nishinaka**, Amagasaki, all of Japan

[73] Assignee: **Hitachi Zosen Corporation**, Japan

[21] Appl. No.: **591,400**

[22] Filed: **Mar. 21, 1984**

[30] **Foreign Application Priority Data**

Nov. 30, 1983 [JP] Japan 58-227742
Nov. 30, 1983 [JP] Japan 58-227743

[51] **Int. Cl.**[3] **B05C 7/00**

[52] **U.S. Cl.** **118/668**; 118/305; 118/323

[58] **Field of Search** 118/668, 305, 323

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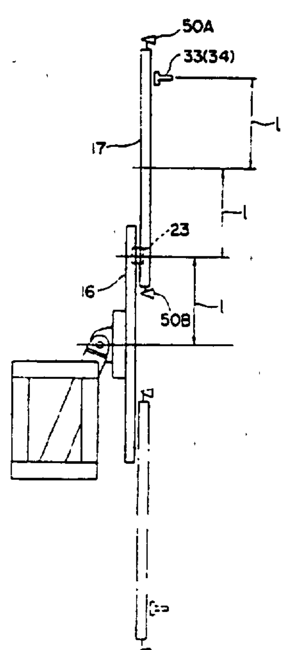
Primary Examiner—Shrive P. Beck
Attorney, Agent, or Firm—Barnes, Kisselle, Raisch, Choate, Whittemore & Hulbert

[57] **ABSTRACT**

A coating apparatus comprising a support assembly, a support moving mechanism for pivotally moving the support assembly about a horizontal axis, an applicator supported by the support assembly upwardly and downwardly movably, a position detector for detecting the raised or lowered position of the applicator, a pair of distance sensors attached to the support assembly and arranged one above the other at a distance for detecting the distance from the work surface to be coated, and a control unit connected to the position detector and to the distance sensors for causing the support moving mechanism to pivotally move the support assembly in response to detection signals from one of the distance sensors closer to the applicator to hold the applicator at a substantially constant distance from the work surface. Even when curved in the direction of the height, the work surface can be coated uniformly because the substantially constant distance is maintained between the applicator and the work surface.

6 Claims, 12 Drawing Figures



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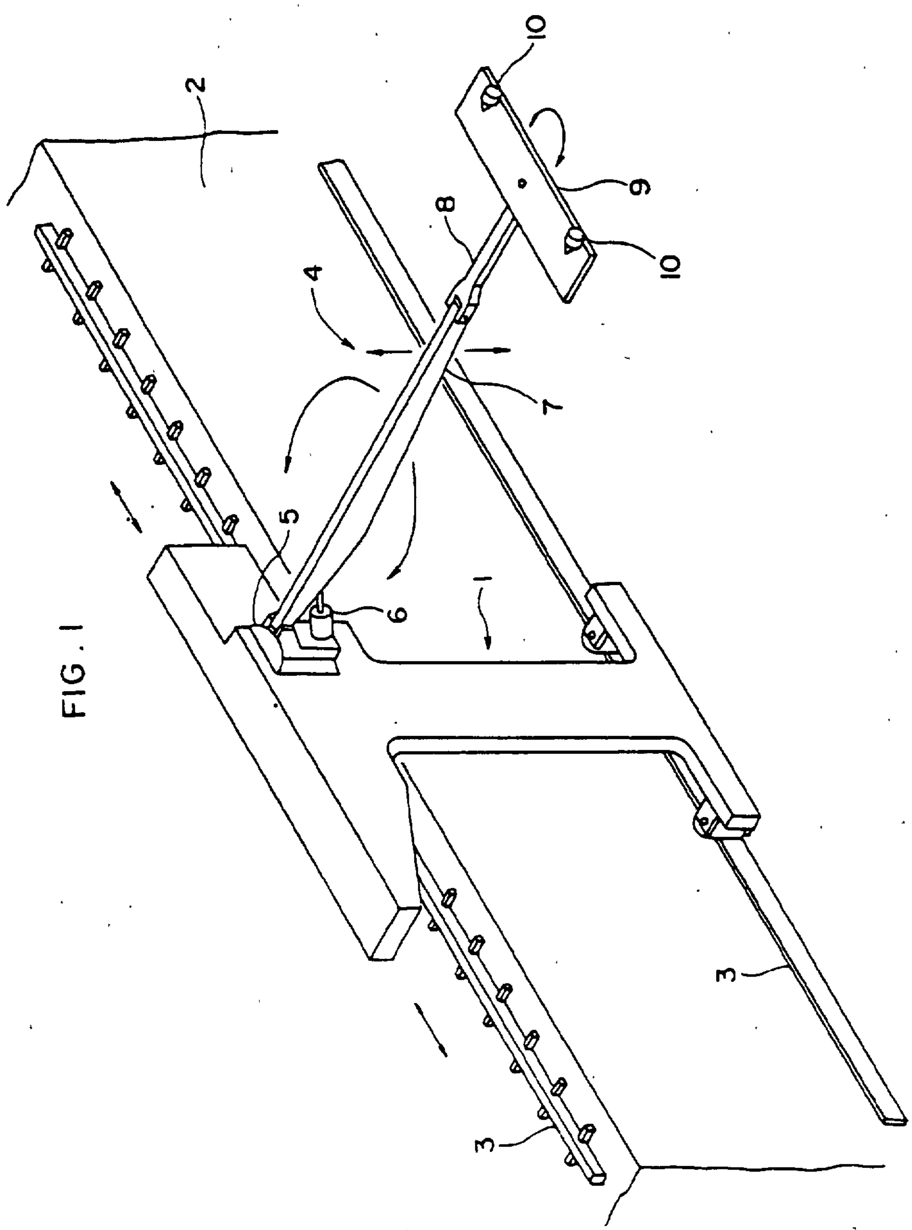

FIG. 1

FIG. 2

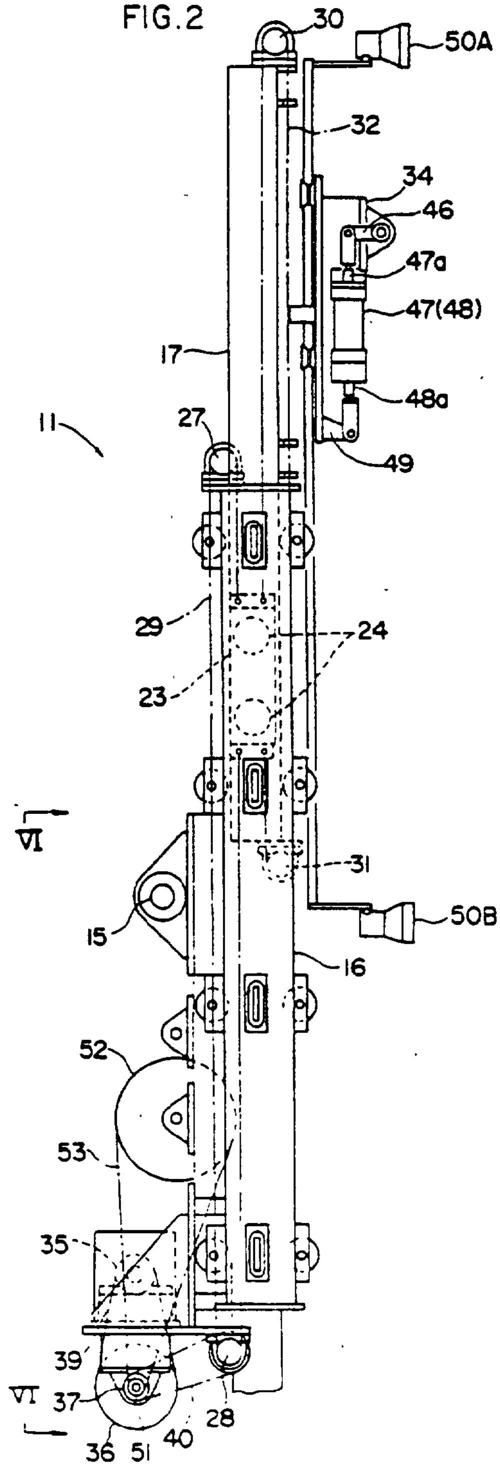
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FIG. 3

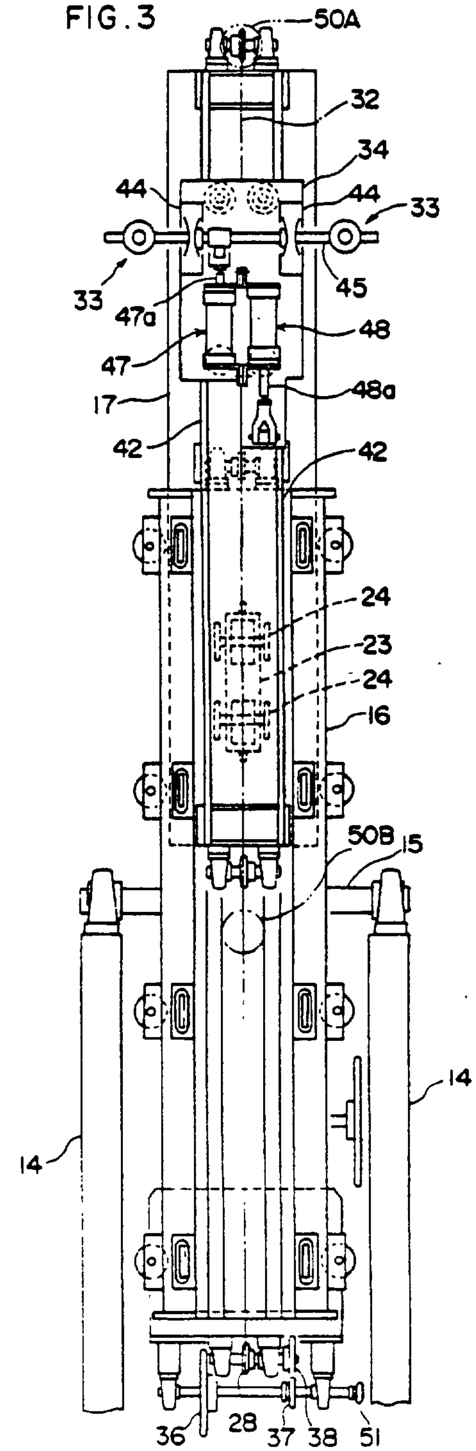

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FIG. 4

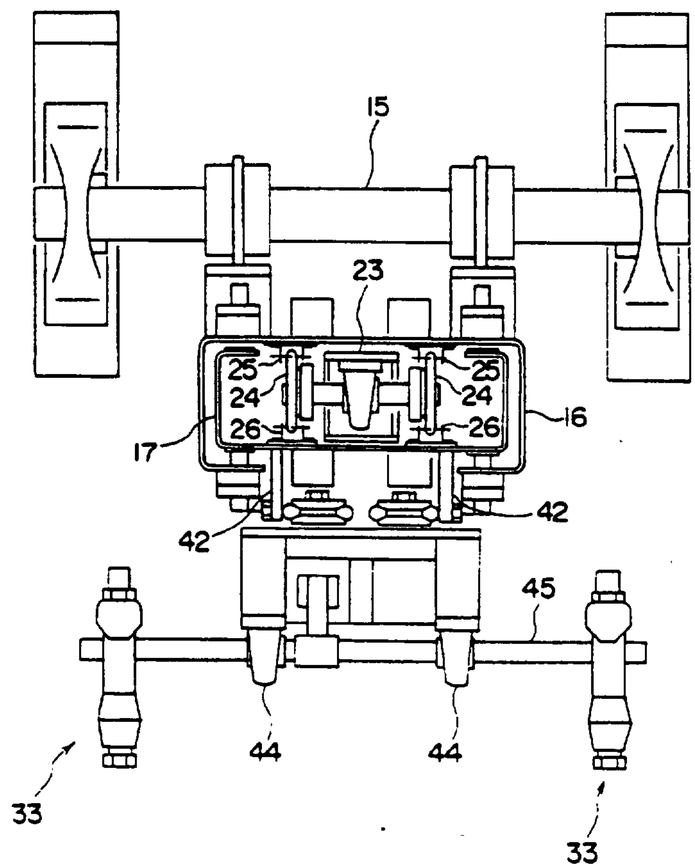


FIG. 5

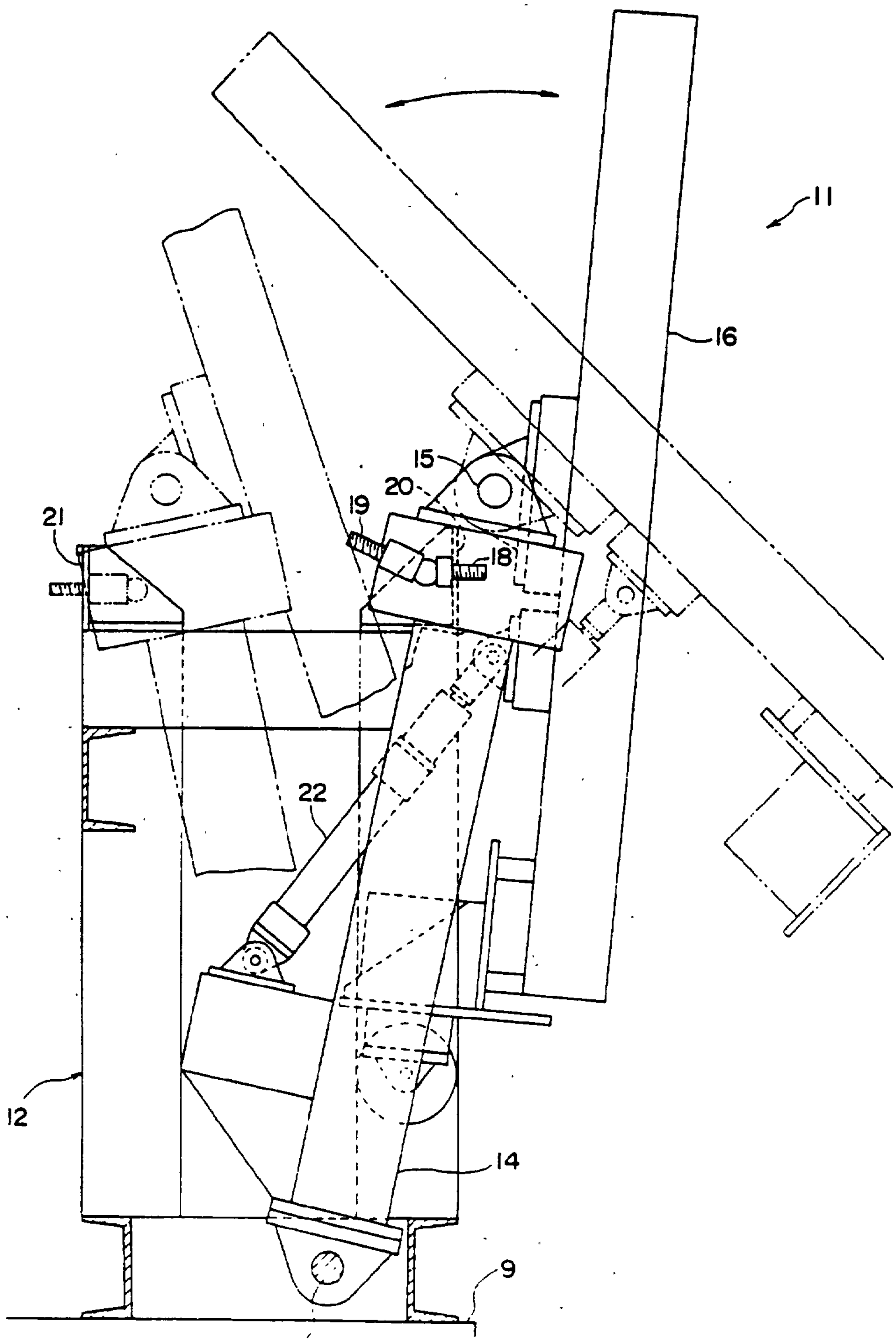


FIG. 6

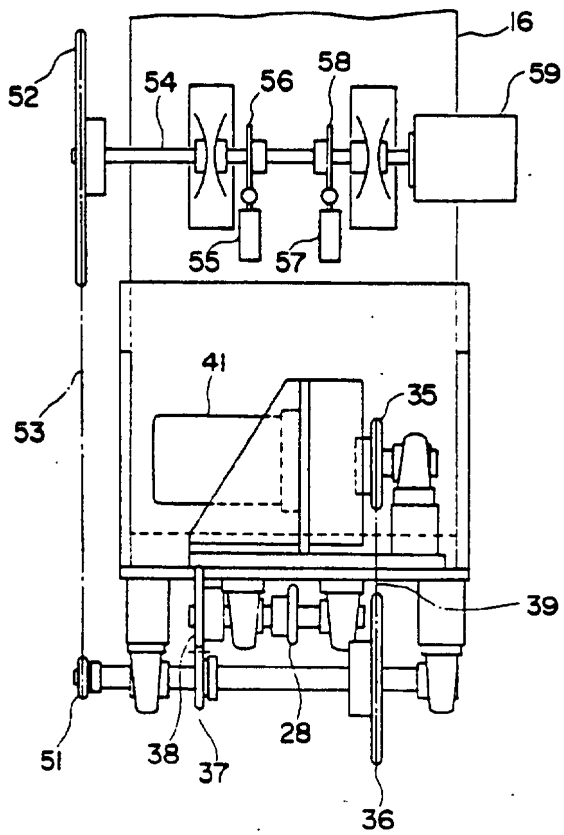


FIG.7

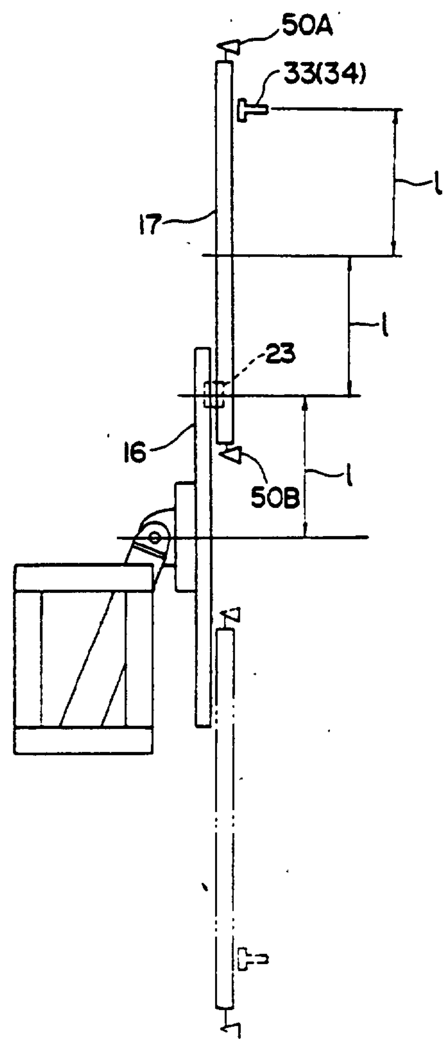


FIG. 8

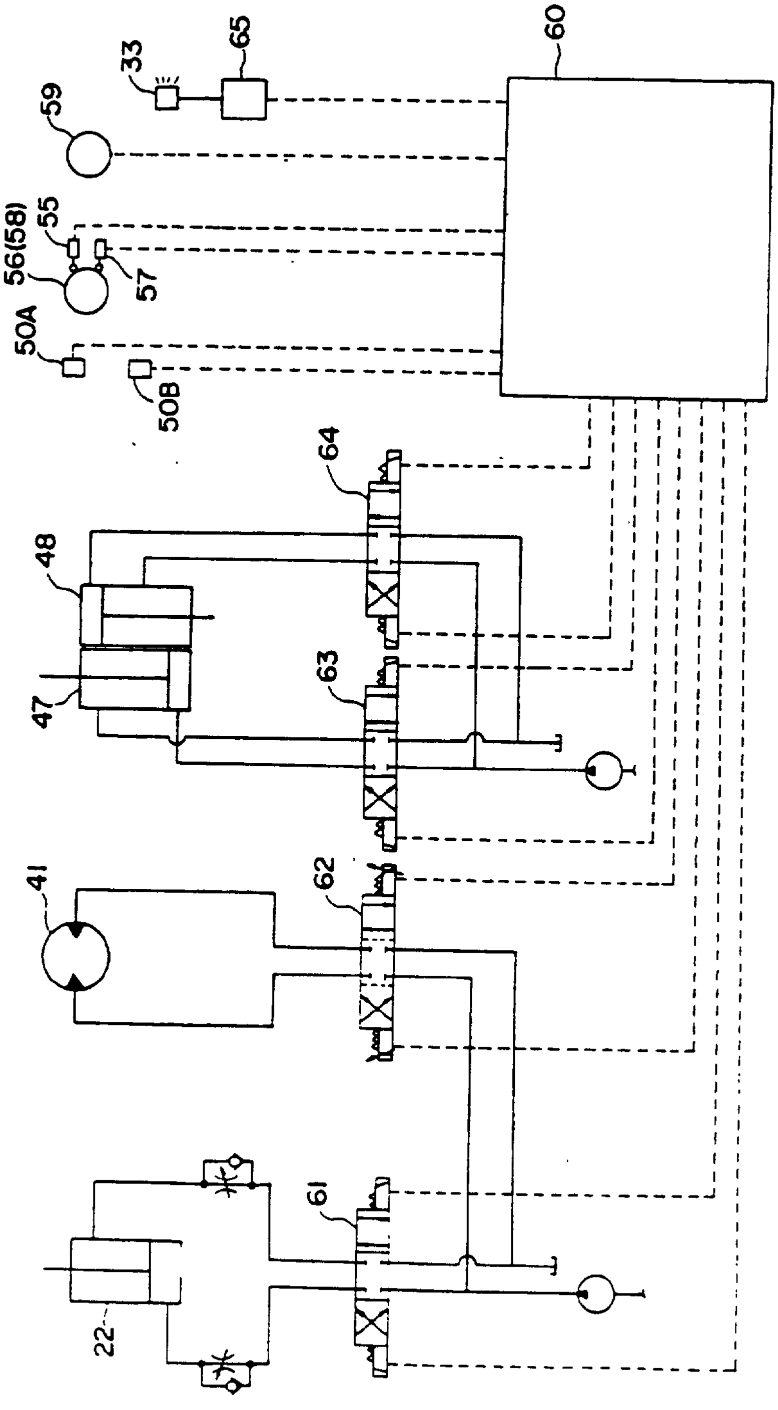


FIG. 9

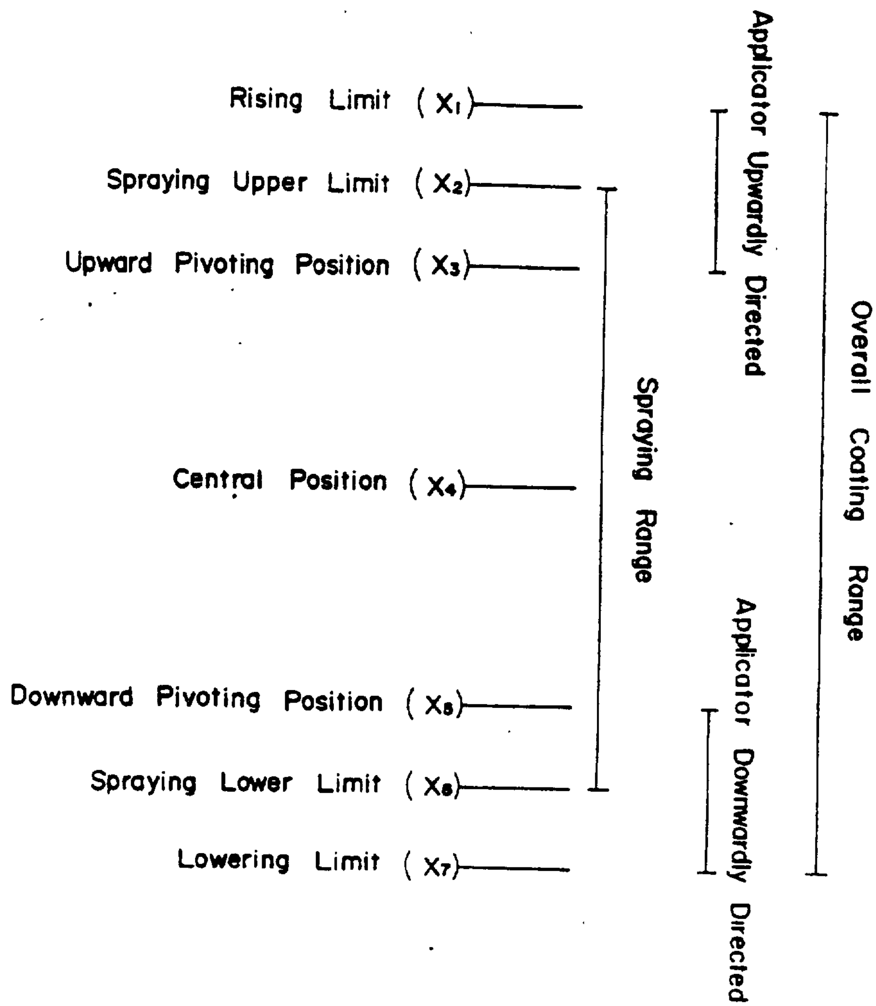
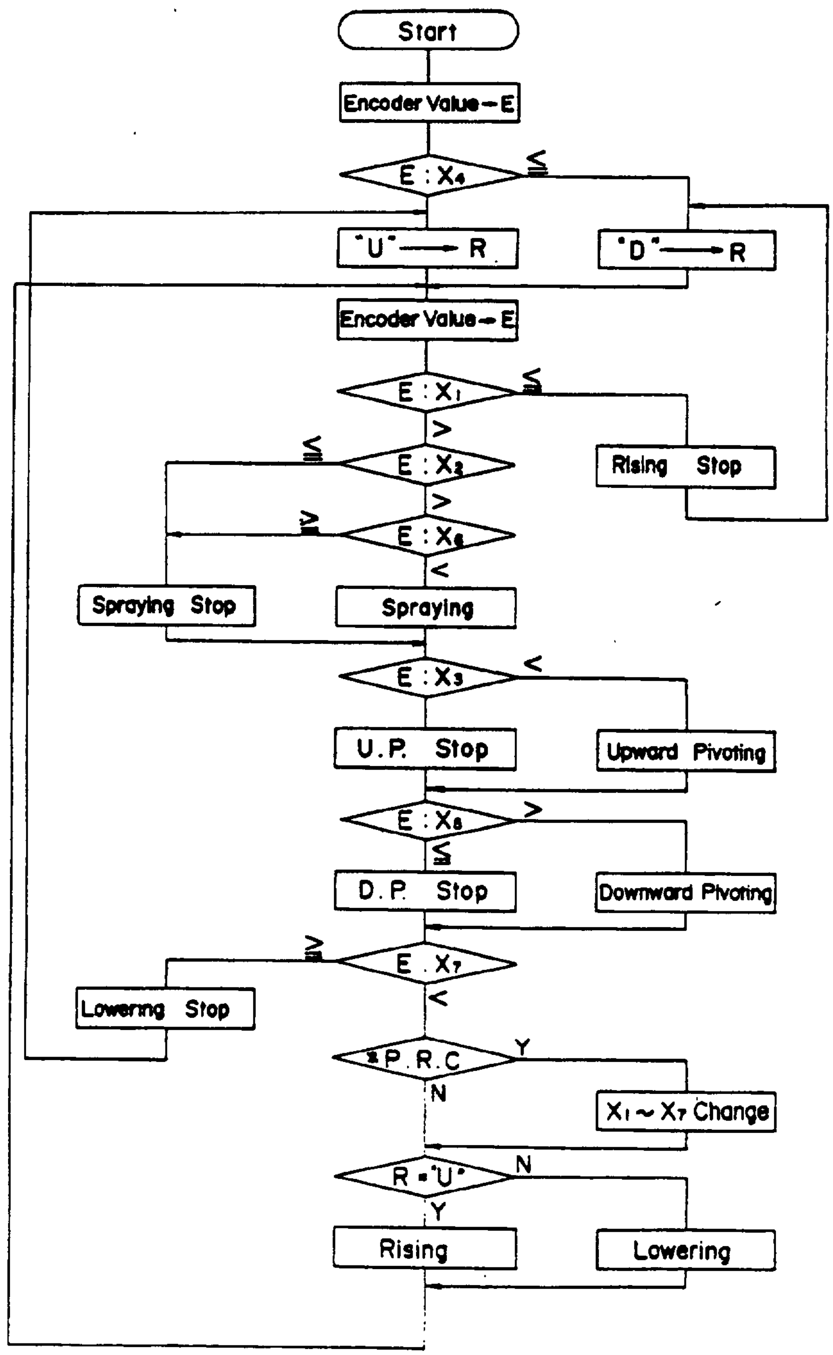

Rising Limit (X_1)
Spraying Upper Limit (X_2)
Upward Pivoting Position (X_3)
Central Position (X_4)
Downward Pivoting Position (X_5)
Spraying Lower Limit (X_6)
Lowering Limit (X_7)
Spraying Range
Applicator Upwardly Directed
Applicator Downwardly Directed
Overall Coating Range

FIG.10



* Coating Range Change

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FIG. 11

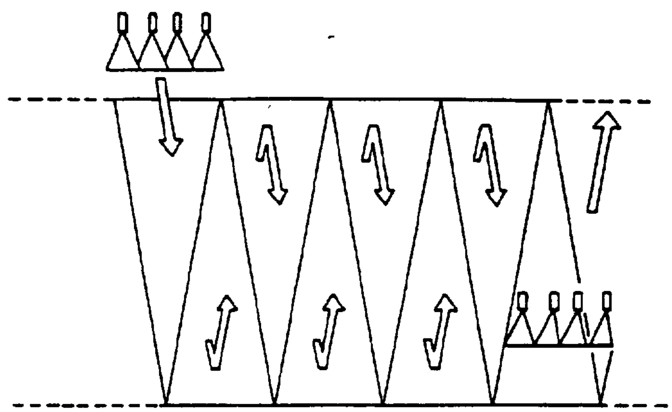
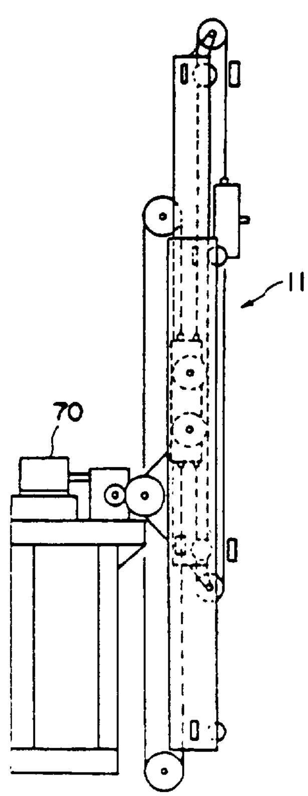


FIG. 12



COATING APPARATUS

The present invention relates to a coating apparatus, and more particularly to a coating apparatus suitable for applying a coating composition to the shell plating of ships during docking.

Laid-Open UK patent application GB 2110647A discloses a coating apparatus including support means which is mounted on a running truck horizontally movable along the surface to be treated and which supports an applicator upwardly or downwardly movably. The support means is pivotally movable about a horizontal axis by a device which is controlled by an operator, whereby the applicator can be held somewhat at a constant distance from the work surface which is curved in the direction of height. While being reciprocated between an upper limit position and a lower limit position, the applicator sprays a coating composition onto the work surface for coating.

However, because the support means moving device is operated by the worker, the known coating apparatus requires skill in holding the applicator at a constant distance from the work surface, while even a skilled worker has difficulties in maintaining the constant distance at all times between the work surface and the applicator which is continuously moved upward and downward, thus failing to assure uniform coating.

An object of the present invention is to provide an apparatus by which even curved surfaces can be coated uniformly and full-automatically.

To fulfill this object, the present invention provides a coating apparatus comprising support means, support moving means for pivotally moving the support means about a horizontal axis, an applicator holder supported by the support means upwardly and downwardly movably and supporting applicator means, holder drive means for moving the applicator holder upward and downward, position detecting means for detecting the raised or lowered position of the applicator holder or the applicator means, a pair of distance detecting means attached to the support means and arranged one above the other at a distance for detecting the distance from the work surface to be coated, and control means connected to the position detecting means and to the distance detecting means for causing the support moving means to pivotally move the support means in response to detection signals from one of the distance detecting means closer to the applicator means to maintain a substantially constant distance between the applicator means and the work surface.

Various features and advantages of the present invention will be readily understood from the embodiments to be described below with reference to the accompanying drawings, in which:

FIG. 1 is an overall perspective view showing a coating apparatus embodying the invention;

FIG. 2 is a side elevation showing support means included in the coating apparatus and provided with an applicator;

FIG. 3 is a front view showing the support means;

FIG. 4 is a plan view of the support means;

FIG. 5 is a fragmentary enlarged view of the support means;

FIG. 6 is a view showing the support means as it is seen in the direction of line VI—VI in FIG. 2;

FIG. 7 is a diagram for illustrating the upward or downward movement of the applicator;

FIG. 8 is a diagram showing the control circuit of the coating apparatus;

FIG. 9 is a diagram showing operating positions of the applicator;

FIG. 10 is a flow chart showing a control process for coating operation;

FIG. 11 is a diagram showing coating cycles; and

FIG. 12 is a fragmentary side elevation showing another embodiment of the invention.

With reference to FIG. 1, a truck 1 is adapted to run horizontally alongside a hull in a dock over the entire length of the hull by being guided by upper and lower rails 3 extending along a side wall 2 of the dock. The running truck 1 is provided with a crane 4. The crane 4 comprises a rotary support 5 mounted on an upper portion of the truck 1 and rotatable about a vertical axis, a pivotal arm 7 supported by the rotary support 5 and pivotally movable about a horizontal axis by a hydraulic cylinder 6, and a rotatable plate 9 supported by a horizontal arm 8 which is held always in a horizontal position to the free end of the pivotal arm 7, the plate 9 being rotatable about a vertical axis. Ultrasonic sensors 10 mounted on opposite ends of the rotatable plate 9 are used for causing the plate 9 to follow the horizontal curve of the outer side surface of the hull.

With reference to FIGS. 2 to 8, support means 11 is mounted on the rotatable plate 9. The support means 11 chiefly comprises a pair of pivotal rods 14 rotatably attached by a horizontal pivot 13 to opposite sides of the lower end of a frame 12 fixedly mounted on the rotatable plate 9, a first support member 16 rotatably connected to the free ends of the pivotal rods 14 by a horizontal pivot 15 and in the form of a channel member which is elongated generally vertically, and a second support member 17 supported by the first support member 16 movably longitudinally thereof and similarly in the form of a channel member which is elongated generally vertically.

Each of the pivotal rods 14 is fixedly provided at its upper end with a front bolt 18 and a rear bolt 19 which extend away from each other. When the front bolt 18 is inserted through a hole formed in a front bracket 20 at the upper end of the frame 12, with an unillustrated nut screwed on the bolt, the pivotal rod 14 can be retained in a forwardly inclined position (shown in solid lines in FIG. 5). When the rear bolt 19 is inserted through a hole formed in a rear bracket 21 at the upper end of the frame 12, with an unillustrated nut screwed on the bolt, the pivotal rod 14 can be held in a rearwardly inclined position (shown in phantom lines in FIG. 5).

A hydraulic cylinder 22 is provided between the pivotal rod 14 and the first support member 16. The first support member 16 is pivotally movable with the second support member 17 by operating the hydraulic cylinder 22.

A movable member 23 is provided between the first support member 16 and the second support member 17 and has engaging wheels (such as sprockets) 24. First and second engaging rails 25, 26 are attached to the opposed faces of the support members 15, 16, respectively. The engaging wheels 24 on the movable member 23 are in engagement with these rails 25, 26. Connected to opposite ends of the movable member 23 are a first roller chain 29 which is reeved around sprockets 27, 28 mounted on opposite ends of the first support member 16 and a second roller chain 32 which is reeved around sprockets 30, 31 on opposite ends of the second support member 17. The second roller chain 32 is connected

also to an applicator holder 32 carrying applicators 33. The sprocket 28 at the lower end of the first support 16 is coupled through sprockets 35 to 38 and chains 39, 40 to a hydraulic motor 41 fixed to the first support member 16. Accordingly when the motor 41 moves the movable member 23 a distance l relative to the first support member 16 as seen in FIG. 7, the second support member 17 moves the same distance l in the same direction relative to the movable member 23, and at the same time, the holder 34, i.e., the applicator 33 attached thereto, move the same distance l in the same direction relative to the second support member 17. In other words, the applicators 33 move three times the distance of movement of the movable member 23.

The holder 34 is movable along a pair of guide rails 42 fixed to the second support member 17. The applicators 33 (such as spray guns for a coating composition) are fixed to a horizontal rotary shaft 45 supported by bearings 44 on the holder 34. A first air cylinder 47 has a piston rod 47a which is connected to the rotary shaft 45 by a link 46. Fixed to the first air cylinder 47 is a second air cylinder 48 having a piston rod 48a which extends in a direction opposite to the piston rod 47a. The piston rod 48a is rotatably connected to a bracket 49 on the holder 34. The applicators 33 are adapted to be brought to their pivoted central position when the piston rod 47a of the first air cylinder 47 is retracted, with the piston rod 48a of the second air cylinder 48 extended. Accordingly, when the piston rod 47a of the first cylinder 47 is extended, the applicators 33 are pivoted downward, while the retraction of the piston rod 48a of the second cylinder 48 pivotally moves the applicators 33 upward.

Upper and lower ultrasonic sensors 50A, 50B for detecting the distance from the side outer surface of the hull (work surface to be coated) are attached to the upper and lower ends of the second support member 17. Further as seen in FIG. 6, the first support member 16 is provided with an input shaft 54 which is coupled through sprockets 51, 52 and a chain 53 to the hydraulic motor 41 for moving the movable member 23 upward or downward. The sprocket 51 is driven by the motor 41 through the sprockets 35, 36 and chain 39. Mounted on the midportion of the input shaft 54 are a first cam plate 56 for actuating a first limit switch 55 for detecting that the applicators 33 are positioned above the central position in the range of travel thereof, and a second cam plate 58 for actuating a second limit switch 57 for detecting that the applicators 33 are below the central position. A rotary encoder 59 is mounted on one end of the input shaft 54 for detecting the position of the applicator 33 during the travel thereof.

As seen in FIG. 8, the signals from the sensors 50A, 50B, the limit switches 55, 57 and the encoder 59 are all fed to a central processing unit (CPU) 60. In response to such signals, the CPU 60 controls the hydraulic cylinder 22, hydraulic motor 41, air cylinder 47 and air cylinder 48 via electromagnetic change-over valves 61 to 64, respectively, and also controls a coating composition feeder 65 for the applicators 33

With the coating apparatus of the above construction, the first support member 16, namely, the support means 11, is controlled by the hydraulic cylinder 22 in the following manner. The first and second limit switches 55, 57 feed signals to the CPU 60, which checks whether the applicators 33 are positioned above or below the central position of the path of travel thereof For example when the applicators 33 are positioned above the central position, the distance signal from the first sensor 50A is compared with a preset distance value. For example if they are found to be away from the hull side outer surface by too large a distance, a signal is given to the electromagnetic change-over valve 61 of the cylinder 22 to bring the first sensor 50A, i.e., the applicators 33, to a position at the preset distance from the outer surface, whereby the means 11 is inclined forward. If the applicators 33 are positioned too close to the hull outer surface, a signal is of course delivered to the valve 61 for moving them away from the hull. Further when the applicators 33 are located below the central position, the second sensor 50B functions to control the support means in the same manner as above. In this way, a substantially constant distance is maintained between the applicators 33 and the side outer surface of the hull over the entire path of travel of the applicators. This eliminates irregularities in the coating that could result from variations in the spraying distance.

The pivotal movement of the applicators 33 is controlled in the manner to be described below with reference to FIG. 9. Along the path of upward-downward movement of the applicators 33, rising limit position, spraying upper limit position, upward pivoting position, central position, downward pivoting position, spraying lower limit position and lowering limit position are set for the applicators from above downward in the order mentioned. Encoded values corresponding to these positions are stored in a memory of the CPU 60 as X1 to X7. Under the control of the CPU 60, a coating composition is sprayed from the applicators 33 within the range of X2 to X6. Between X1 and X3, the applicators 33 are directed upward within an upward angular range of 45 degrees. Between X5 and X7, the applicators 33 are directed upward within a downward angular range of 45 degrees. The applicators 33 are operated in this mode by controlling the hydraulic motor 41, the air cylinders 47, 48 and the composition feeder 65. Accordingly, between X2 and X3, as well as between X5 and X6, the coating composition is sprayed from the applicators 33 while they are being pivoted at all times. The coating composition is therefore applicable uniformly over the entire coating range without producing any coat of increased thickness in the vicinity of the rising upper limit position or the lowering limit position.

Actual coating sequence will be described below chiefly with reference to FIGS. 9 and 10. When the start button (not shown) is depressed, an encoder value E representing the position where the applicators 33 are then located is fed to the CPU 60 and compared with X4. If the encorder value E is greater than X4. i.e., if the applicators are positioned below the central position, an instruction for lowering mode D is set in a register R in the CPU 60, causing the applicator 33 to start lowering When the position of the applicators 33, i.e., the encorder value E, is in the range of X2 to X6, a signal is given to the feeder 65 to initiate application of the coating composition. During the descent of the applicators 33, the encoder value E matches X5, whereupon the CPU 60 feeds to the first air cylinder 47 a signal for pivoting the applicators 33 downward. The applicators 33 are pivotally moved downward from the usual coating posture. When the encoder value E thereafter matches X6, a coating intrruption signal is sent to the feeder 65 to discontinue the coating operation The applicators 33 further reach the lowering limit position, with a match between the encoder value E and X7,

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whereupon a stop signal is emitted to discontinue the decent and downward pivotal movement of the applicators 33. The mode now changes to rising mode U, whereupon the applicators 33 start to rise and are pivoted upward by the first air cylinder 47 (although still directed downward). When the encoder value E becomes identical with X6, coating operation is resumed. As the applicators 33 further rise, the encoder value E matches X5. The applicators 33 are returned to the usual coating posture and brought out of pivotal movement. In this state, the applicators 33 rise to the position of X3 while spraying the composition. At the position of X3, the CPU 60 emits a signal for operating the second cylinder 48, initiating the applicators 33 into upward pivotal movement. At the position of X2, the coating operation is discontinued, and at the position of X1, the applicators 33 stop rising and moving pivotally upward. The applicators 33 thereafter start to descend again in the same manner as above for continual coating operation. While the applicators 33 move upward and downward in reciprocation, the truck 1 (FIG. 1) carrying the support means 11 on the crane 4 continuously moves horizontally. Accordingly the applicators 33 spray the composition in a zigzag fashion as seen in FIG. 11 (showing four spray guns).

Based on the distance measured by the sensors 10 (FIG. 1), the applicators 33 are caused to follow the curve of the outer surface of the hull longitudinally thereof by the crane 4, which is controlled of course by the CPU 60 or other control means connected to the CPU 60.

The support means 11 may be pivoted by a hydraulic or electric stepping motor 70 as shown in FIG. 12.

What is claimed is:

1. A coating apparatus comprising support means, support moving means for pivotally moving the support means about a horizontal axis, an applicator holder supported by the support means upwardly and downwardly movably and supporting applicator means, holder drive means for moving the applicator holder upward and downward, position detecting means for detecting the raised or lowered position of the applicator holder or the applicator means, a pair of distance detecting means attached to the support means and arranged one above the other at a distance for detecting the distance from the work surface to be coated, and control means connected to the position detecting means and to the distance detecting means for causing the support moving means to pivotally move the support means in response to detection signals from one of the distance detecting means closer to the applicator means to maintain a substantially constant distance between the applicator means and the work surface.

2. A coating apparatus as defined in claim 1 wherein the applicator means is mounted on the holder and pivotable about a horizontal axis by applicator pivoting means, the control means being adapted to cause the pivoting means to pivotally move the applicator means upward upon the applicator means reaching a predetermined raised position and to cause the pivoting means to pivotally move the applicator means downward upon the applicator means reaching a predetermined lowered position.

3. A coating apparatus as defined in claim 1 wherein the position detecting means comprises a rotary encoder coupled to the holder drive means.

4. A coating apparatus as defined in claim 1 wherein the support means comprises a first support member elongated in the upward-downward direction and having first engaging rail means and a second support member supported by the first support member movably longitudinally thereof and having second engaging rail means in opposed relation to the first engaging rail means, the applicator means being supported by the second support member upwardly and downwardly movably, the holder drive means including a movable member having engaging wheel means engageable with the two rail means without sliding, means for moving the second support member relative to the movable member by moving the movable member relative to the first support member and means for converting the movement of the second support member relative to the movable member to a movement, equivalent thereto in distance and direction, of the applicator means relative to the second support member.

5. A coating apparatus as defined in claim 1 wherein the support means is attached by a crane to a running truck movable horizontally, and the crane comprises a rotary support mounted on the running truck rotatably about a vertical axis, a pivotal arm having one end supported by the rotary support rotatably about a horizontal axis and pivotally movable by cylinder means, a horizontal arm connected at its one end to the other end of the pivotal arm rotatably about a horizontal axis and held in a horizontal position at all times and a rotatable plate connected to the other end of the horizontal arm rotatably about a vertical axis and having the support means mounted thereon.

6. A coating apparatus as defined in claim 5 wherein the rotatable plate is provided at its opposite ends with a pair of distance detecting means for detecting the distance between the rotatable plate and the work surface.

* * * * *

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United States Patent [19]

Ito

[11] **Patent Number: 4,524,712**

[45] **Date of Patent: Jun. 25, 1985**

[54] **VARNISH COATER FOR PRINTED PRODUCT**

[75] Inventor: **Kiyoshi Ito**, Chiba, Japan

[73] Assignee: **Komori Printing Machinery Co., Ltd.**, Tokyo, Japan

[21] Appl. No.: **576,219**

[22] Filed: **Feb. 2, 1984**

[30] **Foreign Application Priority Data**

Feb 3, 1983 [JP] Japan 58-16602

[51] Int. Cl.³ B05C 1/02

[52] U.S. Cl. 118/46; 118/249; 118/236; 118/262; 101/352

[58] Field of Search .... 118/46, 203, 262, 696, 118/699, 704, 249, 236; 101/350, 351, 352, 416 B

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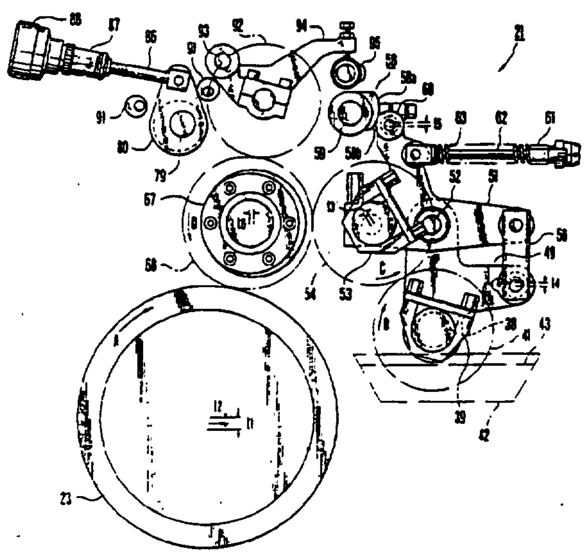
Primary Examiner—John P. McIntosh

Attorney, Agent, or Firm—Blakely, Sokoloff Taylor & Zafman

[57] **ABSTRACT**

In a varnish coater for a printed product, a blanket cylinder and a form roller are respectively supported by eccentric bearings to throw on/off the blanket cylinder with respect to the form roller and an impression cylinder and throw on/off the form roller with respect to the blanket cylinder, and rollers provided in the eccentric bearings of the form roller are brought by biasing means into tight contact with the cam surfaces of cams pivoted by pivot means so as to simplify adjustment of a contact pressure of the form roller with respect to the blanket cylinder at the throw-on and -off positions of the blanket cylinder.

5 Claims, 6 Drawing Figures



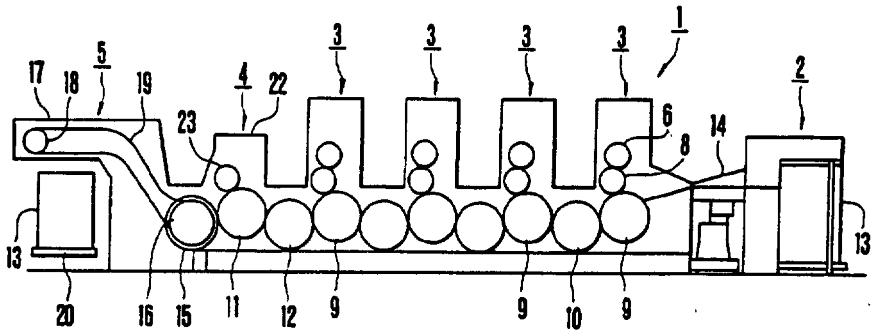

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FIG.1

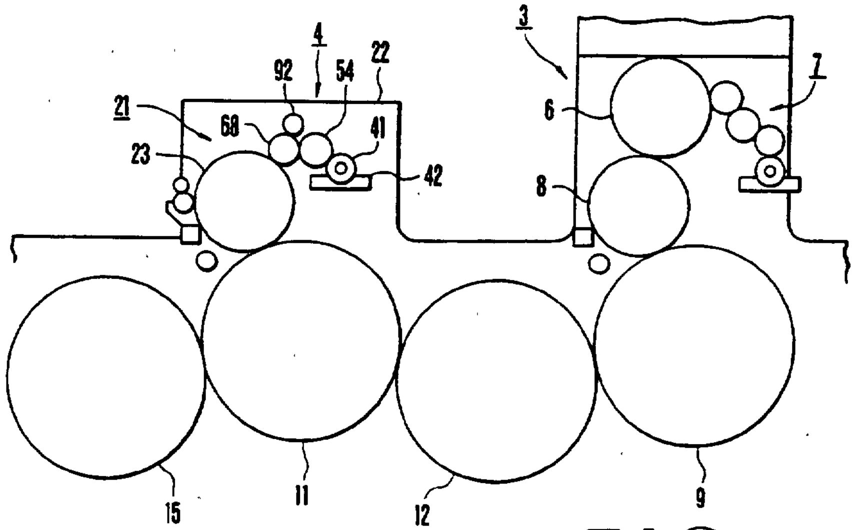
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FIG.2

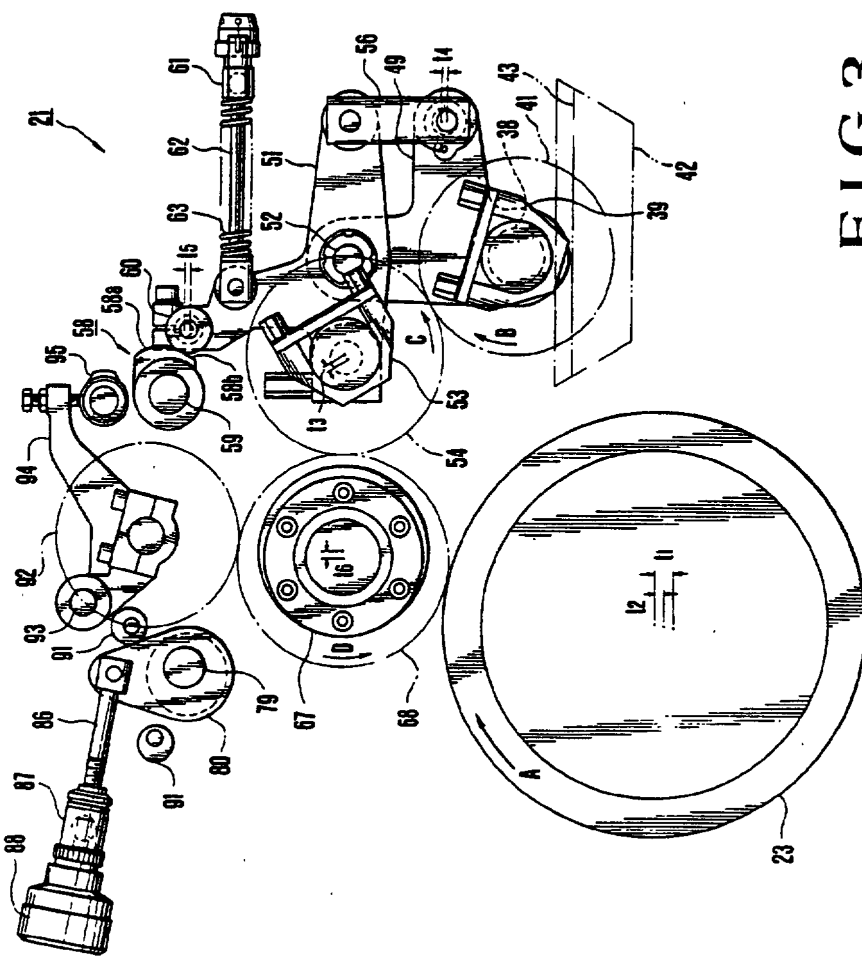
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FIG.3

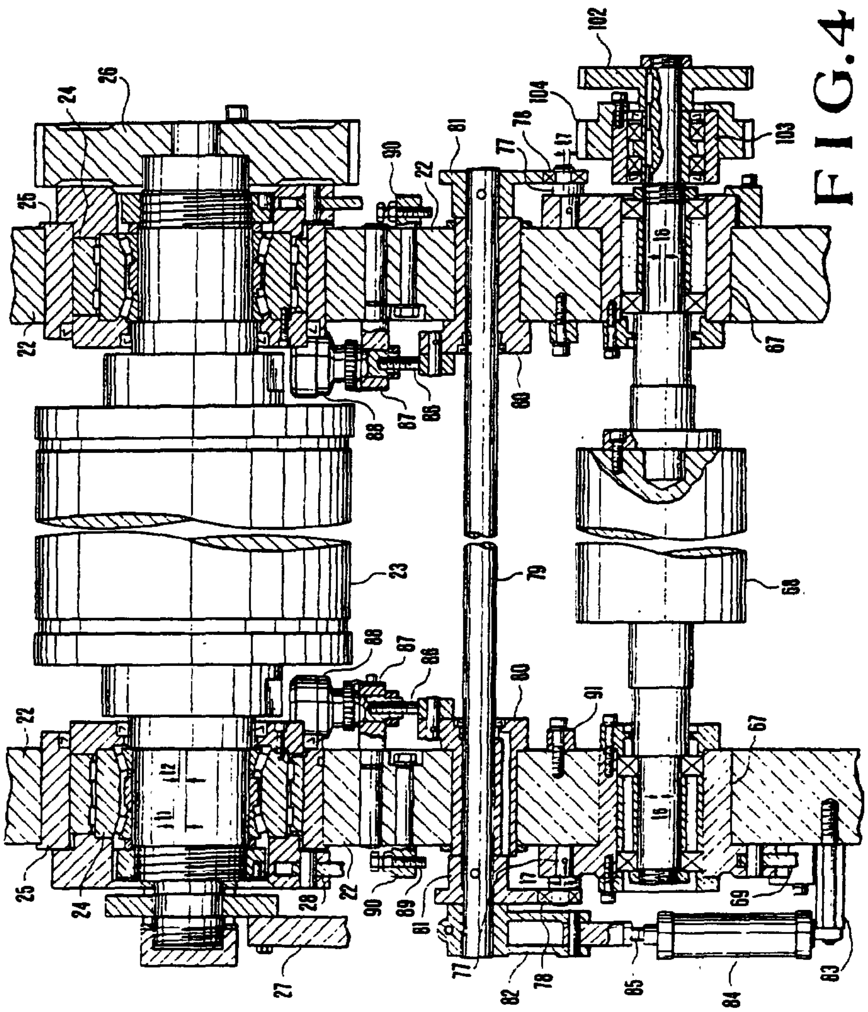

FIG. 4

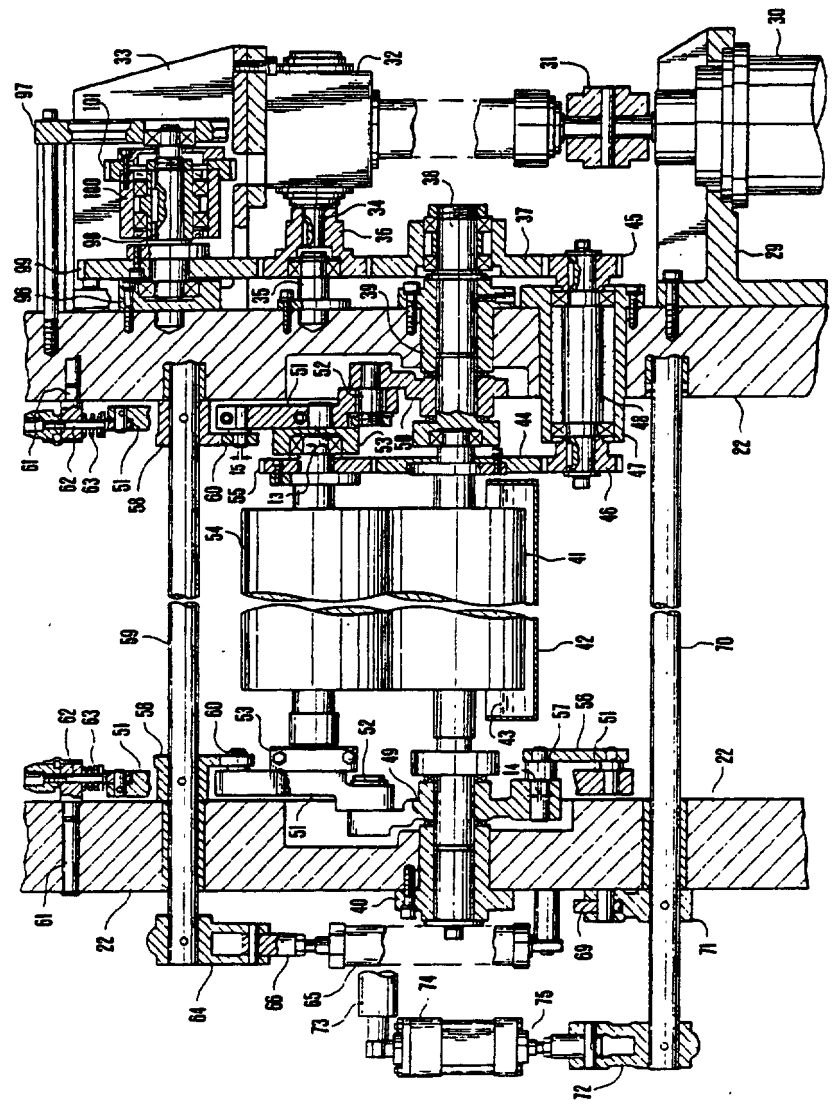

FIG.5

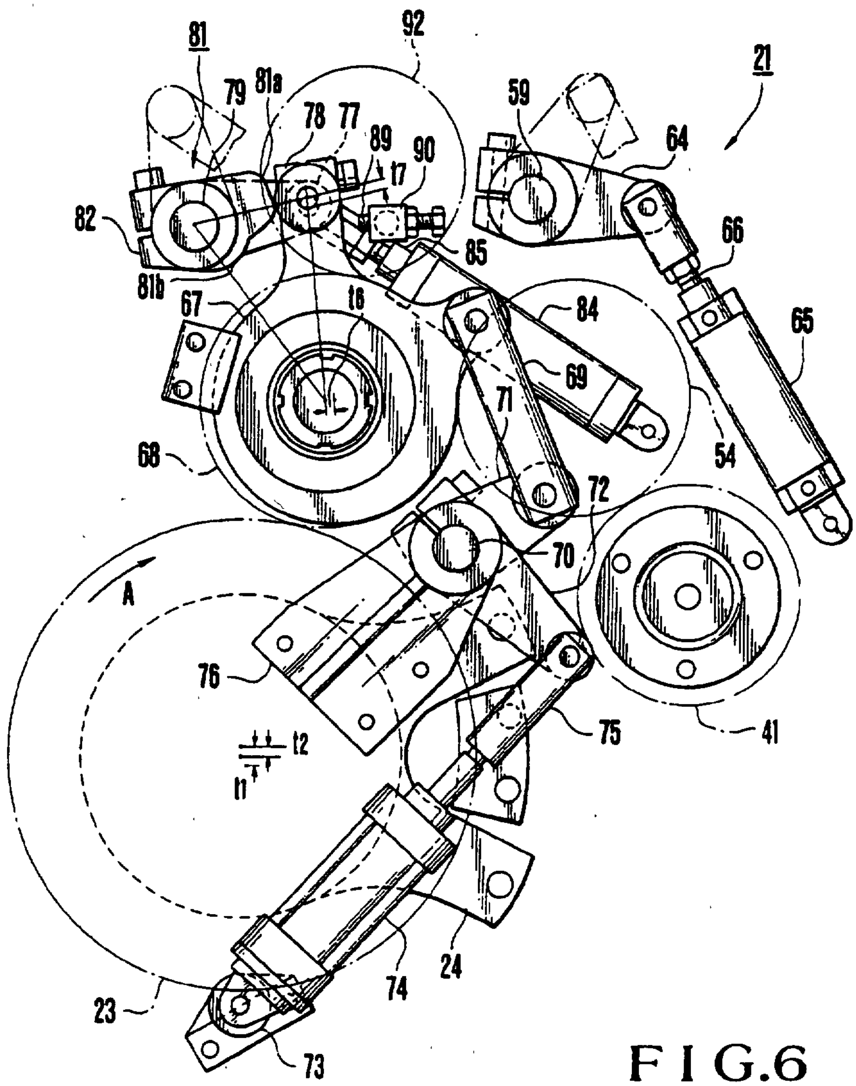

FIG.6

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VARNISH COATER FOR PRINTED PRODUCT

BACKGROUND OF THE INVENTION

The present invention relates to a varnish coater disposed between a printing unit and a delivery apparatus of a rotary press or in an independent coating unit to apply varnish on a printed surface.

The surface of paper printed by a rotary printing press is not quickly dried and can be contaminated in the subsequent processing. In a sheet-fed rotary printing press, offsetting tends to be caused when printed sheets are stacked. In order to solve these problems, conventionally, a dryer is arranged in a delivery path of the printed products, or a powder is sprayed on the printed paper surfaces. However, in this case, the dryer becomes large, and powder spraying results in surface roughening of the printed surface. Surface roughening tends to entail a loss of gloss and subsequent poor printing. Instead of these techniques, varnish is applied to the printed surface to prevent the surface from being contaminated and to give it gloss. Varnishing is performed in printed products such as covers of books, catalogs and pamphlets which require an aesthetic effect.

The varnish coater is used as an independent apparatus. However, recently, the varnish coater is generally disposed in a delivery path of a printing press to shorten a coating time and an associated operation time for restacking the printed sheets and hence to improve the coating efficiency. The varnish coater generally has rollers in the same manner as that of a dampening apparatus for dampening a surface of a plate mounted on a plate cylinder of the printing unit. Varnish stored in a varnish pan is supplied to a surface of a blanket cylinder through the rollers. The varnish is transferred to a sheet passing between the blanket cylinder and an impression cylinder.

However, the conventional varnish coater of this thick paper such as a cover. The blanket on the surface of the blanket cylinder is partially deformed to result in a nonuniform thickness of the varnish film. In this case, a thickness of an underlay inserted between the blanket and the metal surface of the blanket cylinder must be adjusted after the rotary printing press is stopped. When the rollers are stopped for a long period of time while the coating operation is interrupted, varnish is hardened and many wasted paper sheets are produced when the coating operation is restarted. In order to prevent this, the rollers inserted between the form roller and the varnish type has the following problem in contact pressure adjustment between the blanket cylinder and the form roller for transferring varnish to the blanket cylinder. During the coating operation, since the blanket cylinder is in sliding contact with the form roller which transfers varnish to the blanket cylinder, the contact pressure of the form roller with respect to the blanket cylinder must be properly adjusted to obtain a uniform thickness of the varnish film to be coated on the printed sheet. On the other hand, the coating operation is often performed for pan must be brought into sliding contact with the form roller. After the blanket cylinder is washed or cleaned, the underlay is adjusted. Subsequently, after the underlay is adjusted, the blanket cylinder is located in the throw-on position. In this case, in order to properly perform the coating operation, the form roller must be brought into tight contact with the blanket cylinder to transfer varnish from the form roller to the blanket cylinder before the blanket cylinder is located in the throw-on position. The adjusting condition is preferably checked. For this purpose, the contact pressure of the form roller with respect to the blanket cylinder must be properly adjusted even if the blanket cylinder is located in the throw-off position.

In this manner, the contact pressure of the form roller with respect to the blanket cylinder must be controlled for both the throw-on and throw-off positions of the blanket cylinder. Conventionally, the contact pressure is adjusted by a turnbuckle and an eccentric pin, or by stoppers for defining the pivotal range of the form roller support arm. In addition, the contact pressure adjustments are independently performed at the throw-on and throw-off times of the blanket cylinder. The contact pressure adjustment must be performed every time irregular thickness is eliminated or the blanket of the blanket cylinder is worn out, resulting in time-consuming operation. In addition to this disadvantage, since an impact occurs when the form roller is brought into tight contact with the blanket cylinder by means of the form roller arm, the durability of the component parts is degraded upon repetition of the above contact operation. Furthermore, when the contact pressure is adjusted at the throw-on and -off positions, the pressure adjusted at one of the positions influences that at the other, resulting in inconvenience.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a varnish coater capable of simplifying adjustment of a contact pressure of a form roller with respect to a blanket cylinder at the throw-on and -off positions of the blanket cylinder.

It is another object of the present invention to provide a varnish coater capable of smoothly contacting the form roller with the blanket cylinder and improving the durability of the coater.

In order to achieve the above and other objects, the blanket cylinder and the form roller are respectively supported by eccentric bearings to throw on/off the blanket cylinder with respect to the form roller and an impression cylinder and throw on/off the form roller with respect to the blanket cylinder, and rollers provided in the eccentric bearings of the form roller are brought by biasing means into tight contact with cam surfaces of cams pivoted by pivot means.

According to the present invention, there is provided a varnish coater for coating varnish transferred from a form roller to a blanket cylinder on a printed sheet passing through the blanket cylinder and an impression cylinder, comprising:

first eccentric bearings for supporting the form roller;

rolling members mounted on outer end portions of the first eccentric bearings, respectively;

cams which are pivotally supported by second eccentric bearings, respectively, and each of which has a large diameter portion and a small diameter portion which are selectively brought into contact with a corresponding one of the rolling members,

first pivoting means for pivoting the cams;

biasing means for biasing the rolling members each of which is brought into tight contact with one of the large and small diameter portions of a corresponding one of the cams; and

second pivoting means for pivoting the second eccentric bearings to shift an axis of a cam shaft of the cams.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic side view of a four-color sheet-fed offset rotary printing press;

FIG. 2 is a schematic side view of a fourth color printing unit and a coating unit of the rotary printing press shown in FIG. 1;

FIG. 3 is a side view of a varnish coater of the coating unit shown in FIG. 2 according to an embodiment of the present invention;

FIG. 4 is a developed sectional view of a portion including a blanket cylinder and a form roller of the varnish coater shown in FIG. 3;

FIG. 5 is a developed sectional view of a portion including a pan roller and a metering roller of the varnish coater shown in FIG. 3; and

FIG. 6 is a side view of a throw-on and -off mechanism for rollers in correspondence with the portion shown in FIG. 3 when viewed from the outside of the frame.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIGS. 1 and 2, a four-color sheet-fed offset rotary printing press 1 comprises a sheet feeder 2, four color printing units 3, a coating unit 4 and a delivery apparatus 5. These components are separately assembled and constitute the rotary printing press 1. Each printing unit 3 has a plate cylinder 6 having a printing plate thereon, an inking apparatus (not shown) for supplying a corresponding ink to the cylinder surface, and a dampening apparatus 7 for supplying dampening water to dampen the cylinder surface. A blanket cylinder 8 is brought into contact with each plate cylinder 6 on which an image is formed by utilizing the corresponding color ink and water. The image on the plate cylinder 6 is transferred to the blanket cylinder 8 upon relative rotation therebetween. In each printing unit 3, an impression cylinder 9 having a diameter twice that of the blanket cylinder 8 is brought into contact therewith. A transfer cylinder 10 having the same diameter as the impression cylinder 9 is sandwiched between adjacent impression cylinders 9 of the corresponding printing units 3. An impression cylinder 11 having a diameter twice that of a blanket cylinder 23 (having the same construction as the blanket cylinder 8) of the coating unit 4 is disposed to be in contact with the blanket cylinder 23 and at the same level as the other impression cylinders 9 of the printing units 3. A transfer cylinder 12 is sandwiched between the impression cylinder 9 of the fourth color printing unit 3 and the impression cylinder 11 of the coating unit 4. Paper sheets 13 stacked on the feed table of the sheet feeder 2 are taken up by a sheet pick-up device (not shown) and are fed one by one onto a feedboard 14. Each sheet 13 is gripped with grippers of the first color impression cylinder 9 by means of a swing gripper. The sheet 13 is printed by the blanket cylinders 8 with four colors while the sheet 13 is sequentially fed by the transfer cylinders 10 and the corresponding impression cylinders 9. The printed sheet is then gripped by grippers of the impression cylinder 11 and is wound therearound.

The delivery apparatus 5 comprises a delivery cylinder 15 which is brought into contact with the impression cylinder 11, and a pair of right and left sprockets 16 which are coaxially mounted on the delivery cylinder 15. Delivery chains 19 each having grippers at equal intervals are respectively looped between the right and left sprockets 16 and front end sprockets 18 of a delivery frame 17. The sheet 13 gripped by the grippers of the impression cylinder 11 is gripped by the grippers of the chains 19 and transferred thereby. The sheet 13 is released from the grippers of the chains onto a stack board 20.

The coating unit 4 having the construction described above has a varnish coater 21 to be described below.

Referring mainly to FIG. 4, the blanket cylinder 23 having the same diameter as that of the blanket cylinder 8 is rotatably supported by right and left frames 22, respectively, through pairs of antifriction bearings 24 and plain bearings 25. The blanket cylinder 23 is rotated in the direction indicated by arrow A (FIG. 3) upon rotation of a cylinder gear 26 coupled to a driving source. The axes of the bearings 24 and 25 are respectively deviated by distances t1 and t2 with respect to the axis of the blanket cylinder 23. A lever 27 pivotally mounted on the corresponding rolling bearing 24 of the frame 22 is reciprocated by means of an air cylinder to bring the blanket cylinder 23 into contact with or separate it from the impression cylinder 11. A lever 28 pivotally mounted on the plain bearing 25 is reciprocated by a handle to adjust the contact pressure between the blanket cylinder 23 and the impression cylinder 11.

Referring mainly to FIG. 5, a DC variable motor 30 is supported and mounted on a bracket 29 fixed on the outer surface of one of the frames 22. A gear box 32 coupled to the shaft of the motor 30 through a coupling 31 is supported and mounted on a bracket 33 fixed on the outer surface of this frame 22. A driving gear shaft 34 is coupled to the motor shaft through a bevel gear which is disposed in the gear box 32 to be perpendicular to the motor shaft. A driving gear 36 supported by a stud 35 which extends outward from the frame 22 is fixed on the driving gear shaft 34. A gear shaft 38 is supported on the frame 22 through a bearing 39 to rotatably support an intermediate gear 37 meshing with the driving gear 36. One end of a pan roller 41 is rotatably supported by the bearing portion of the gear shaft 38 extending inwardly of the frame 22. The other end of the pan roller 41 is supported by a bearing 40 of the opposing frame 22. The pan roller 41 is dipped in varnish 43 stored in a varnish pan 42. A pan roller gear 44 is fixed on a collar in the vicinity of the gear shaft 38. Reference numerals 45 and 46 denote gears which respectively mesh with the intermediate gear 37 and the pan roller gear 44 to transmit a rotational force of the intermediate gear 37 to the pan roller 41. The gears 45 and 46 are mounted on a gear shaft 48 supported by a bearing 47 which is mounted on the frame 22. The pan roller 41 rotates in a direction indicated by arrow B (FIG. 3). L-shaped roller arms 49 and 50 (the shape of the roller arm 49 is illustrated in FIG 3 in detail) are movably mounted between the collar of the pan roller 41 and the bearing 40 and between the collar of the gear shaft 38 and the bearing 39 through thrust bearings, respectively Inverted T-shaped arms 51 (the shape thereof is illustrated in FIG. 3 in detail) are pivotally mounted through pins 52 on corresponding free ends of the L-shaped roller arms 49 and 50, respectively. A bearing 53 is pivotally mounted on the free end of each of the T-shaped arms 51 such that the axis of the bearing 53 is deviated by a distance t3 (FIGS. 3 and 5) with respect to the shaft of a metering roller 54 having an elastic surface. Therefore, the roller 54 is supported by the bearings 53 and is brought in contact with the pan roller 41. A gear 55 mounted on the end portion of the

shaft of the roller 54 is meshed with the pan roller gear 44, so that the roller 54 is rotated in the direction indicated by arrow C (FIG. 3). Bolts are loosened to pivot the bearings 53 so as to adjust a nip pressure acting on the pan roller 41.

One of the roller arms 49 is coupled to the corresponding T-shaped arm 51 through a lever 56 having an eccentric portion indicated by a distance t4 (FIGS. 3 and 5). A pin 57 of the eccentric portion is manually pivoted to throw on/off the metering roller 54 with respect to the pan roller 41. Reference numeral 58 denotes cams each having a large diameter portion 58*a* (FIG. 3) and a small diameter portion 58*b* (FIG. 3). The cams 58 are mounted on end portions of a cam shaft 59 mounted across the right and left frames 22. These end portions are adjacent to the inner surface portions of the right and left frames 22, respectively. Rollers 60 eccentrically (indicated by a distance t5) mounted on the free ends of the T-shaped arms 51 are in contact with the cam surfaces of the cams 58, respectively. Pivotal spring shafts 62 are mounted on studs 61 extending inward from the frames 22. One end of each of pivotal spring shafts 62 is pivotally mounted on the corresponding T-shaped arm 51. The T-shaped arms 51 urge the rollers 60 which tend to abut against the cams 58 by means of compression coil springs 63 mounted on the spring shafts 62, respectively. A piston rod 66 of an air cylinder 65 having an end mounted on the corresponding frame is pivotally coupled to the free end portion of a lever 64 fixed on the end of the cam shaft 59. When the piston rod 66 is moved to pivot the cams 58, the metering roller 54 can be brought into contact with or separated from the pan roller 41 through the rollers 60 and the T-shaped arms 51.

Referring again to FIGS. 3 and 4, eccentric bearings 67 (indicated by a distance t6 in FIG. 3) are respectively mounted on the frames 22 above the blanket cylinder 23. A form roller 68 is supported by the eccentric bearings 67 and is brought into contact with the blanket cylinder 23. As shown in FIG. 4, one end of a connecting lever 69 is coupled to an outwardly extended portion of one of the eccentric bearings 67, and the other end thereof is coupled to a lever 71 which is mounted on a lever shaft 70 mounted on the frame 22. An actuator end of a piston rod 75 of an air cylinder 74 pivotally coupled to the stud 73 extending outwardly from the frame 22 is coupled to a lever 72 fixed on the other end of the lever shaft 70. When the piston rod 75 of the air cylinder 74 is moved to pivot the eccentric bearings 67 through the coupling lever 69 and the like, the form roller 68 can be thrown on/off with respect to the blanket cylinder 23 Referring to FIG. 6, reference numeral 76 denotes a bearing fixed on the bracket at the side of the frame 22 to support the lever shaft 70 outside the frame 22. As shown in FIG. 4, the roller shafts 77 are split-clamped to be pivoted. Inner rings of rollers 78 each comprising a ball bearing are respectively fixed at the eccentric portions deviated by distances t7 with respect to the axis of the roller shaft 77. Reference numeral 79 denotes a cam shaft supported by the right and left frames 22 respectively through eccentric bearings 80. As shown in FIG 6, the position of the cam shaft 79 is preset such that the axes of the cam shaft 79, the roller 78 and the form roller 68 correspond to apexes of a right angled triangle. Cams 81 each having a large diameter portion 81*a* and a small diameter portion 81*b* are split-clamped on the cam shaft 79. In other words, the cams 81 are respectively pivotal about the eccentric bearings 80 through the cam shaft 79. A lever 82 is split-clamped on the projecting end of the cam shaft 79, and the actuator end of a piston rod 85 of an air cylinder 84 pivotally supported by the frame 22 through a stud 83 is pivotally coupled to the free end portion of the lever 82. Bolts 86 respectively extend from the extended portions of the eccentric bearings 80 which extend inside the frames 22. The bolts 86 respectively engage with nuts such that these bolts 86 are inserted in handles 88 supported by studs 87 so as not to move axially. When the handles 88 are turned to move the bolts 86 so as to turn the eccentric bearings 80, respectively, the cams 81 are eccentrically moved together with the cam shaft 79 to shift its axis. In this throw-on and -off mechanism of the form roller 68, when the piston rod 75 (FIG. 5) of the air cylinder 74 is shortened (i.e., when the eccentric bearings 67 are pivoted clockwise in FIG. 6), the form roller 68 is separated from the blanket cylinder 23. In this case, the eccentric direction of the bearings 67 is preset such that the form roller 68 is separated from the blanket cylinder 23 while the distance between the form roller 68 and the metering roller 54 is kept to be substantially constant. In the state shown in FIG. 6, the blanket cylinder 23 is in contact with the form roller 68. In this case, the piston rod of the air cylinder 84 is shortened, and the large diameter portion 81*a* of each cam 81 is in contact with the corresponding roller 78. The roller 78 is biased by an air pressure of the air cylinder 74 to abut against the corresponding cam 81. Furthermore, when the blanket cylinder 23 is removed and the form roller 68 is thrown on the blanket cylinder 23, the piston rod 85 of the air cylinder 84 is elongated to pivot the cams 81 counterclockwise. As a result, the rollers 78 are respectively brought into contact with the small diameter portions 81*b* of the cams 81 by means of the biasing force of the air cylinder 74. Therefore, the form roller 68 is held in a state wherein it contacts the blanket cylinder 23. In other words, in the throw-on and -off positions of the blanket cylinder 23, the contact forces of the form roller 68 with respect to the blanket cylinder 23 are limited by the large diameter portions 81*a* and the small diameter portions 81*b* of the cams 81. Adjustment of these contact forces is effected by the movement of the cam 81 caused by the turning of the handle 88. Referring to FIG. 4, reference numeral 89 denote off-position stoppers which are screwed in studs 90 on the frames 22, respectively. When the blanket cylinder 23 is located in the throw-on position, the piston rod 75 of the air cylinder 74 is shortened, and the eccentric bearings 67 are respectively pivoted until they abut against the stoppers 89. Therefore, the throw-off position of the form roller 68 can be defined with respect to the throw-on position of the blanket cylinder 23. Referring to FIG 4, reference numeral 91 denotes stoppers for defining the eccentric pivotal movement of the cams 81 when the lever 82 respectively abuts against the stoppers 91. As shown in FIG. 3, a rider roller 92 is supported at each end thereof by an arm 94 pivotal about a pin 93 on the side of the frame 22 and is brought in tight contact with the form roller 68. The arm 94 swings upon pivotal movement of a cam 95 by means of a handle (not shown), so that the rider roller 92 can be thrown on/off with respect to the form roller 68.

A drive mechanism of the motor 30, the cylinder gear 26 and the form roller 68 will be described.

One end of a clutch shaft 98 is supported by a bearing 96 fixed on the frame 22 in the vicinity of the motor 30, and the other end thereof is supported by a bracket 97

extending from the frame 22. A gear 99 is fixed on the clutch shaft 98 and is meshed with the driving gear 36 to transmit rotation of the motor 30 to the clutch shaft 98. A clutch gear 101 fixed on a one-way clutch 100 (to be described in detail later) on the clutch shaft 98 is meshed with a form roller gear 102 fixed in the end portion of the roller shaft of the form roller 68. The one-way clutch 100 has a known structure capable of transmitting a rotational force in only one direction. In this embodiment, the form roller 68 is a driven member, so that the rotational force of the motor 30 is transmitted only to the form roller 68. A one-way clutch 103 having the same construction as the one-way clutch 100 is arranged in an end portion of a roller shaft of the form roller 68. A clutch gear 104 coupled to the one-way clutch 103 is meshed with the cylinder gear 26 of the blanket cylinder 23. In this case, the form roller 68 is the driven member for the one-way clutch 103, so that the rotational force of the blanket cylinder 23 is transmitted only to the form roller 68. In this manner, the form roller 68 is selectively driven by the motor 30 and the blanket cylinder 23 through the one-way clutches 100 and 103; the form roller 68 does not simultaneously receive the rotational forces through the one-way clutches 100 and 103. Either of the one-way clutches 100 and 103 which transmits a higher rotational speed is coupled to the form roller 68, and the other one of the one-way clutches 100 and 103 which transmits a lower rotational speed is decoupled from the form roller 68.

The operation of the varnish coater 21 having the arrangement described above will now be described. The motor 30 of the varnish coater 21 is started to perform the coating operation while the blanket cylinder is located at the throw-off position. The cams 58 are pivoted by the air cylinder 65 to abut the rollers 60 against the small diameter portions 58*b* of the cams 58, respectively, so that the metering roller 54 is brought into tight contact with the pan roller 41 and the form roller 68 by means of the biasing forces of the compression coil springs 63. In this case, the piston rod 75 of the air cylinder 74 is elongated so that the rollers 78 of the eccentric bearings 67 are respectively brought into tight contact with the large diameter portions 81*a* of the cams 81. The form roller 68 is located in the throw-on position. However, since the blanket cylinder 23 is located in the throw-off position, the form roller 68 is separated from the blanket cylinder 23. In this case, the rotation of the motor 30 is transmitted to the pan roller 41 and the metering roller 54 through the bevel gear in the gear box 32, and the gears 36, 37, 45, 46, 44 and 55. The rotation of the motor 30 is also transmitted to the form roller 68 through the gears 36 and 99, the one-way clutch 100 and the gears 101 and 102. The blanket cylinder 23 is separated from the impression cylinder 11, and these cylinders are stopped. Upon rotation of the above-mentioned rollers, the varnish 43 is drawn by the pan roller 41 from the varnish pan 42. A thickness of the varnish film is adjusted upon contact between the pan roller 41 and the metering roller 54. The varnish film having a predetermined thickness is transferred to the form roller 68. Varnish circulates through the pan roller 41, the metering roller 54 and the form roller 68 When the rotary printing press is started to feed a sheet 13 onto the feedboard 14 by means of the automatic feeder 2, the blanket cylinders 8 of the printing units 3 are located in the throw-on positions, so that the sheet 13 is subjected to four-color process printing through the blanket cylinders and the corresponding impression cylinders 9. The printed sheet is fed toward the coating unit 4. When the printed sheet reaches the coating unit 4, the plain bearings 25 are pivoted in response to the command from a timing controller, so that the blanket cylinder 23 is located in the throw-on position, and that the blanket cylinder 23 is brought into tight contact with the impression cylinder 11 and the form roller 68. Varnish circulating between the form roller 68 and the pan roller 41 is transferred to the blanket cylinder 23 and is applied to the printed sheet passing between the blanket cylinder 23 and the impression cylinder 11. The coated sheet 13 is fed by the delivery chains 19 and is stacked on the stack board 20. In the throw-on position of the blanket cylinder 23, the rotational force is transmitted from the motor 30 to the form roller 68 through the one-way clutch 100. At the same time, since the blanket cylinder 23 is located in the throw-on position, the rotational force of the blanket cylinder 23 is transmitted to the form roller 68 through the gears 26 and 104 and the one-way clutch 103. The rotational speed of the blanket cylinder 23 is higher than that of the motor 30, so that only the rotational force of the blanket cylinder 23 is transmitted to the form roller 68. The one-way clutch 100 is decoupled from the form roller 68.

The throw-on/off operation of the form roller 68 and the adjustment of the contact pressure of the form roller 68 with respect to the blanket cylinder 23 during the coating operation will be described.

During the coating operation as previously described, the blanket cylinder 23 is located in the throw-on position with respect to the impression cylinder 11 and the form roller 68. In other words, the blanket cylinder 23 is brought into tight contact with the impression cylinder 11 and the form roller 68. In this case, the rollers 78 are respectively in contact with the large diameter portions 81*a* of the cams 81. The piston rod 75 of the air cylinder 74 is biased in a direction toward which the piston rod 75 is elongated by the air pressure. The rollers 78 are in tight contact with the large diameter portions 81*a* of the cams 81, so that the pivotal movement of the eccentric bearings 67 are defined by the tight contact between the rollers 78 and the corresponding large diameter portions 81*a*. As previously described, when the blanket of the blanket cylinder 23 is partially deformed and the thickness of the varnish film becomes nonuniform, the rotary printing press is stopped to eliminate irregular thickness of the underlay. In this case, the blanket cylinders 8 of the printing units 3 are located in the throw-off positions. At the same time, the blanket cylinder 23 of the varnish coater 21 is also located in the throw-off position with respect to the impression cylinder 11 and the form roller 68. Even if the blanket cylinder 23 is located in the throw-off position, the gear 26 continues to mesh with the the gear 104. The form roller 68 continues to be driven by the blanket cylinder 23 through the one-way clutch 103. At the same time, the pan roller 41 and the metering roller 54 continues to be driven by the motor 30, so that the varnish circulates between the varnish pan 42 and the form roller 68 and will not be hardened. The rollers 78 are held in contact with the large diameter portions 81*a* of the cams 81, respectively, so that the form roller 68 is separated from the blanket cylinder 23. After the blanket cylinder 23 is cleaned, the underlay of the blanket is adjusted to eliminate the nonuniform thickness of the underlay After the adjustment is completed, the air cylinder 84 is actuated to elongate the piston rod 85. When the cams 81 are pivoted counterclockwise (FIG.

6) through about 90°, the rollers 78 are pivoted until they are respectively brought into tight contact with the small diameter portions 81*b* of the cams 81 since the eccentric bearings 67 are biased by the air cylinder 74. Therefore, the form roller 68 is brought into contact with the blanket cylinder 23 which is located in the throw-off position, so that the varnish in circulation is transferred from the form roller 68 to the blanket cylinder 23. In this condition, the operator can visually observe and check varnish coating from the form roller 68 to the blanket cylinder 23, thereby checking the result of underlay adjustment. When the printing operation is then restarted, the air cylinders 74 and 84 are actuated in response to predetermined time signals from the timing controller. The rollers 78 are brought into tight contact with the large diameter portions 81*a* of the cams 81 and the blanket cylinder 23 is located in the throw-on position. Therefore, the form roller 68 is brought into tight contact with the blanket cylinder 23 at a contact pressure preset by the cams 81 and the rollers 78.

In the coating operation performed in the manner as described above, when the blanket cylinder 23 is located in the throw-on position, the rollers 78 are respectively brought into tight contact with the large diameter portions 81*a* of the cams 81 by the air pressure of the air cylinder 74. The contact pressure of the form roller 68 with respect to the blanket cylinder 23 is defined by the tight contact between the rollers 78 and the corresponding large diameter portions 81*a*. On the other hand, when the blanket cylinder 23 is located in the throw-off position, the rollers 78 are respectively brought into tight contact with the small diameter portions 81*b* by the air pressure of the air cylinder 74. In this manner the contact pressure of the form roller 68 with respect to the blanket cylinder 23 is defined by the tight contact between the rollers 78 and the small diameter portions 81*b*. The contact pressure can be adjusted by rotating the eccentric bearings 80 mounted on the cam shaft 79 by means of handles 88. In other words, the contact pressure can be adjusted by a change in distance between the axes of the cam 81 and the corresponding roller 78. In this case, even if the position of the cam 81 is changed, the position of the large diameter portion 81*a* is not changed relative to that of the small diameter portion 81*b*. Only by changing the position of the cams 81, the contact pressures at the times when the blanket cylinder 23 is located in the throw-on and -off positions can be simultaneously adjusted. When split-clamping is released to pivot the roller shafts 77 of the rollers 78, the rollers 78 can be moved away from or closer to the axis of the roller 68. As is apparent from FIG. 6, the eccentric bearings 67 are slightly rotated, so that the difference (i.e., cam lift) between each small diameter portion 81*b* and the corresponding large diameter portion 81*b* can change. Therefore, the contact pressure at the time of throw-on operation of the blanket cylinder 23 relative to that at the time of throw-off operation thereof can be adjusted. In this case, if at least one of the large diameter portion 81*a* and the small diameter portion 81*b* comprises a concentric arc but has a slope along the circumferential direction, the cam lift can be easily changed. The zero contact pressure point adjustment can be easily performed An error in the manufacturing process can be properly absorbed, and an adjustment at the time of wear can be easily performed

In the above embodiment, the rollers 78 are respectively brought into tight contact with the surfaces of the cams 81 by the air cylinder 74 as the biasing means. If the form roller 68 need not be located in the throw-off position with respect to the blanket cylinder 23 when the blanket cylinder 23 is located in the throw-off position, the biasing means may comprise a coil spring in place of the air cylinder.

As is apparent from the above description, in the varnish coater for the printed product according to the present invention, the blanket cylinder and the form roller are respectively supported by eccentric bearings to throw on/off the blanket cylinder with respect to the form roller and an impression cylinder and throw on/-off the form roller with respect to the blanket cylinder, and the rollers provided in the eccentric bearings of the form roller are respectively brought by biasing means into tight contact with cam surfaces of cams pivoted by pivot means so as to change with an identical magnitude contact pressures of the form roller with respect to the blanket cylinder at the throw-on and -off positions of the blanket cylinder. By changing the position of the axis of the cam, the contact pressures of the form roller with respect to the throw-on and -off positions of the blanket cylinder can be simultaneously adjusted. Therefore operability can be greatly improved as compared with the conventional mechanism wherein the contact pressures are adjusted by the turnbuckle and the like, thereby improving the operation efficiency and decreasing labor. In addition to these advantage, since the form roller is brought into tight contact with or is separated from the blanket cylinder upon pivotal movement of the eccentric bearings, the impact caused by the contact between the form roller and the blanket cylinder is decreased, and durability of the members can be improved. In addition, the contact pressure adjustment at the time of throw-on position of the blanket cylinder will not influence that at the time of throw-off position thereof. Furthermore, the rollers can be adjusted to be away from and closer to the form roller. When the slope is formed on the cam surface along the circumferential direction of the cam, the cam lift can be changed. The error in the manufacturing process can be absorbed, and the cam lift adjustment at the time of wear of the cam surface can be easily performed.

What is claimed is:

1. A varnish coater for coating varnish transferred from a form roller to a blanket cylinder on a printed sheet passing through the blanket cylinder and an impression cylinder, comprising:

first eccentric bearings for supporting said form roller;

rolling members mounted on outer end portions of said first eccentric bearings, respectively;

cams which are pivotally supported by second eccentric bearings, respectively, and each of which has a large diameter portion and a small diameter portion which are selectively brought into contact with a corresponding one of said rolling members;

first pivoting means for pivoting said cams;

biasing means for biasing said rolling members each of which is brought into tight contact with one of said large and small diameter portions of a corresponding one of said cams; and

second pivoting means for pivoting said second eccentric bearings to shift an axis of a cam shaft of said cams.

2. A varnish coater according to claim 1, wherein said first pivoting means comprises:

an air cylinder which is operated in response to a given timing signal;

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a piston rod which is reciprocally inserted in said air cylinder; and

a lever coupled between said piston rod and one of said cams to pivot said cams.

3. A varnish coater according to claim 1, wherein said biasing means comprises:

an air cylinder which is operated in response to a given timing signal;

a piston rod which is reciprocally inserted in said air cylinder;

a first lever one end of which is connected to said piston rod;

a second lever one end of which is connected to the other end of said first lever; and

a connecting lever one end of which is connected to the other end of said second lever and the other end of which is coupled to an extended portion of one of said first eccentric bearings.

4. A varnish coater according to claim 1, wherein said second pivoting means comprises:

bolts mounted on extended portions of said second eccentric bearings, respectively;

handles coupled to said bolts through studs, respectively; and

stoppers for defining a range of pivotal movement of each of said second eccentric bearings.

5. A varnish coater according to claim 1, wherein said cam shaft has an axis which constitutes a right-angled triangle together with axes of said rolling members and said form roller.

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United States Patent [19]

Ganho

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[54] **PROCESS AND COMPOSITIONS FOR LITHOGRAPHIC PRINTING IN MULTIPLE LAYERS**

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[58] **Field of Search** 106/290, 300, 307, 310, 106/316; 427/258; 428/499; 524/270–274, 284, 313, 441, 477–478, 764, 798; 527/600

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[57] **ABSTRACT**

Printed materials such as tickets, lottery forms, cards and contest forms, bearing a hidden message which is revealable by scratching off a covering opaque layer, are prepared by printing the message on the substrate, lithographing a protective layer such as a clear varnish or a pigmented varnish-ink over the hidden message, and then lithographing a hiding coat over the applied protective layer. The protective layer formulation and the hiding coat layer are both based upon compatible, preferably the same, film forming resin systems, and are deposited from a common solvent. The protective layer may provide a clear, colorless transparent film through which the message may be viewed, or a colored see-through layer, so that it constitutes one color layer also for the printing of other areas of the substrate.

4 Claims, No Drawings

W019302

PROCESS AND COMPOSITIONS FOR LITHOGRAPHIC PRINTING IN MULTIPLE LAYERS

FIELD OF THE INVENTION

This invention relates to printing methods and printing ink compositions. More particularly, it relates to methods and compositions for making sheets such as paper sheets or cards covered with superimposed layers of print, the lower of which comprises a "hidden" message which is masked from a reader unless and until an upper coating is removed, e.g. by abrasion, scratching and erasures.

BACKGROUND OF THE INVENTION

Recently, the preparation and distribution of promotional game cards, premium cards, lottery tickets and the like, containing hidden messages or symbols has become popular and widespread, in fund raising and product promotion. The recipient of such a card must remove from the card a layer of hiding coating in order to reveal a message or symbol. Such items are, however, difficult to prepare and print in an economical fashion, because of the technical specifications they must fulfill.

Such a card bearing a hidden message normally has at least two coating layers overlying a hidden message. Immediately over the message, a transparent or translucent protective layer is provided, through which the message can be read. Over the protective layer, an opaque second layer ("hiding layer") is applied in order to hide the message. The hiding layer can be subsequently stripped away e.g. by scratching etc., to reveal the message through the first coat.

It is necessary that there exists, as between the protective coat or layer and the hiding coat or layer an acceptable degree of adhesion or affinity, so that the hiding coat remains in place and opaque to hide the message during storage, shipping, packaging and transportation of the cards. Nevertheless, the hiding coat ("scratch-off coat") must be readily removable by abrasion by the user at the required time, to render the message visible, leaving the first coat susbtantially unaffected.

Effectively, one must satisfy two essentially contradictory requirements in the relationship between the varnish coat and the hiding coat, to render them mutually compatible and adhesive to one another at one time, and imcompatible and non-adhesive to one another at another time.

Heretofore, these mutually inconsistent requirements have been satisfied by using a thick hiding coat applied by silk screen methods, over a thin varnish coat applied by lithographic methods or by silk screen methods. In view of its thickness and consistency, the only practical way of applying the hiding coat is by silk screening. This is costly and inconvenient. Lithography is the cheapest, fastest way of printing and applying coatings to such cards. To have to apply one coating by lithography and the other coating by silk screening entails the transfer of the card stock from one printing machine to another, or even the transferring from one printing plant to another printing plant, with consequent added inconvenience, extra expense and loss of security.

SUMMARY OF THE INVENTION

The present invention provides an improved process for preparing printed or coated cards or similar items

bearing hidden messages under a layer of protective coat and a layer of hiding coat superimposed thereon. In the process of the present invention, both the protective coat and the hiding coat may be applied to the card lithographically. To facilitate this, the protective coat formulation and the hiding coat formulation are deposited from compatible solvent sysytems and contain mutually compatible resin systems. Then the hiding coat, containing opacifying pigments, can be applied as a thin layer, suitably formulated to be applied by lithography, and still exhibit the necessary hiding power whilst being abrasively removable. In addition, if desired, further printing of patterns can be applied over the hiding coat.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The protective coat formulation and the hiding coat formulation have film-forming resin systems which are mutually compatible. Preferably they comprise generally the same resins or types of resins in both formulations. The protective coat formulation may comprise a pigment free varnish, so as to produce a light coloured translucent or transparent film when dried and cured in place to reveal the message below. Alternatively and preferably however, the protective coat is pigmented with a light coloured pigment so that it may constitute one of the printing colour formulations for application to other areas of the substrate, so as to save one application step in the process. As compared with varnish previously used for this purpose, the protective coat used in the present invention has a higher energy surface, less repellant to and compatible with the pigmented hiding coat. The protective coat formulation contains curatives (hardeners) which will result in the formulation of a hard, cured film, but which is not so hard as to reject the application of the hiding coat. The hiding coat preferably contains the same or similar film forming resin system, but is cured to a lesser degree. The relative degree of cure between the two layers helps to adjust the degree of adhesion between them tending to fulfill the contradictory requirements mentioned above, and permits the scratch-off removal of the hiding coat.

Preferably, the hiding coat contains pigments or opacifying agents which render the finished coat not only visibly opaque but also opaque to all other forms and wavelenghts of radiation also so that the hidden message cannot be prematurely revealed e.g. by x-rays, UV light etc. For this purpose the hiding coat formulation should contain a powdered metal such as powdered aluminum, in addition to regular pigments such as carbon black, dyes etc.

Examples of suitable resins for use in both the protective coat (clear or pigmented varnish-ink formulation) and the hiding coat formulation are phenolic resins such as phenolic modified rosin esters, hydrocarbon resins, alkyd resins such as linseed-isophthalic alkyd and other unsaturated alkyds resins and the like, and mixtures thereof. Such resin systems are curable with heavy metal-organic salt such as manganese octoate and cobalt octoate, to yield the light coloured or transparent films. They can be plasticised if desired, e.g. with waxes of the hydrocarbon type. When a clear varnish is required, the varnish formulation should of course be free from pigments, but may contain other ingredients in minor proportions to modify its surface properties. For example, small amounts of Montan wax, Carnuaba wax or an-

other natural or synthetic wax of similar characteristics, can be added to give a harder surface finish. Such a wax component may in fact migrate to the surface of the coating after curing ("bloom") and then contribute to the surface characteristics of the cured varnish layer. When a pigmented varnish-ink is required, a conventional pigment compatible with the solvent and resin formulation is used therein. The hiding coat formulation should include a drying oil such as refined linseed oil, and smaller amounts of curative, along with opacifying agents, to yield a film of suitable hiding qualities and compatibility with the protective film, yet readily abrasively removable therefrom.

As noted, both the protective layer formulation and the hiding coat formulation should be deposited from compatible solvent sytems, preferably from the same solvent system. Hydrocarbon solvents (e.g. Magie oil, a mixture of aliphatic and aromatic oils) are preferred. The protected layer formulation will normally contain substantially larger proportions of solvent, and hence be of substantially thinner consistency, than the hiding coat formulation. Both formulations are nevertheless of a suitable consistency for application by lithography. The solvent used for the hiding coat should not be capable of penetrating the cured protective layer coat to any significant extent, despite the fact that the very same solvent may well have constituted the vehicle for deposition of the uncured protective layer. Accordingly, a fast drying system is chosen, which cures to a hard finish to prevent solvent and pigment penetration thereof from the hiding coat, but which nevertheless "traps" the subsequently applied hiding coat to the necessary degree.

In order to be satisfactory for lithographic application, an ink formulation must be adjusted in relation to the printing machine speed, to adjust its rate of drying and curing. On a high speed machine, the amount of heat generated by the machine may cure the protective layer formulation to such an extent the the applied layer will not transfer from the plate cylinder to the rubber blanket cylinder and on down the roller train. Accordingly, depending upon the speed and nature of the lithographic printing machine by means of which the protective layer is to be applied, it may be necessary to retard the drying or hardening of the rate of the protective layer as compared with the normal varnishes. This is most commonly encountered when using clear, non-pigmented varnishes in the present invention as the hiding coat. When a slower speed of machine is employed, such retardation may not be necessary.

The following is a preferred general formulation for a clear, non-pigmented varnish for use as the protective layer in the present invention particularly for use with fast running web litho printing machines, with the ingredients expressed as percentages by weight.

Components	% Range
Magie oil (solvent)	30-35
Phenolic modified rosin ester	16-20
Hydrocarbon resin (e.g. of the PICCOPALE* type)	13-17
Linseed-isophthalic alkyd	10-13
Hydrocarbon plasticizer (e.g. of the DUTREX* type)	7-10
Montan wax	3-6
Calcium perborate	1.5-3
Manganese octoate	1.5-2
Cobalt octoate	0.5-1
Gelling agent	0.5-0.7

-continued

Components	% Range
Chinawood oil	0.3-0.5

*Trade mark

In this formulation, cobalt octoate, manganese octoate and calcium perborate constitute the curing system. The calcium perborate helps to cure the chinawood oil, by supplying oxygen thereto. Similar hydrocarbon flexibilizer may be used in place of DUTREX as the plasticizer. Also similar hydrocarbon rosins may be used in place of PICCOPALE. The chinawood oil (tung oil) is optionally added, to adjust the consistency and tackiness of the surface. The gelling agent also adjusts the consistency of the formulation. As gelling agent, there can be used any suitable product from the reaction of an unsaturated fatty acid, a solvent and calcium octoate. Alternatively, thickener such as fumed silica may be used as or instead of a gelling agent.

For clear varnish application using a slower, sheet fed machine, such a varnish might not result in a coating which would satisfactorily trap the hiding coat. The above formulation would accordingly be modified for example, by reducing or omitting one or more of the gelling agents, calcium perborate, chinawood oil, wax or hydrocarbon resin.

In the preferred process according to the present invention, the card or paper stock is initially printed, in a first colour, with the indica to be subsequently covered with the "scratch-off" hiding coat (the "hidden message") at the appropriate location, lithographically. At the same time and from the same plate, any other areas of the stock may be appropriately printed with the same colour, e.g. with text, picture, design, etc. Normally, the first colour will be the darkest colour to be applied, e.g. black or dark blue. The ink composition used for the first lithographic application step may be of the composition according to the invention, i.e. a varnish-ink, or a standard conventional lithographic ink suited to the base stock.

In the next step of the preferred process, the stock is overprinted lithographically with a second colour, of a varnish-ink according to the invention, at least in the area of the "hidden message", as a solid block covering it. This second colour may be applied wet-on-wet over the first colour. Preferably it is restricted to cover only the area of the "hidden message", but may if desired be used to apply additional text or colour to other areas of the stock. Red is a suitable choice for the second colour. The "hidden message" is still readable through the applied second coat.

There then follow optional steps of lithographic application of additional colour, to complete the printing of the stock. If it is required to produce full-colour printing on the stock, e.g. with full colour illustration, two more colours, e.g. green and yellow, are applied successively, wet-on-wet, over the second colour by lithographic means. Thus a standard four-colour lithographic printing machine can be used. If any of the subsequently applied colours are to cover the "hidden message", then the composition of such colour must be a varnish-ink according to the present invention. It is however preferred to avoid further coating of the "hidden message" with the subsequently applied colours, so that they can be formulated according to standard lithographic ink formulation, compatible with the stock and the previously applied coats. It is however to be empha-

sized that the third and fourth colour applications are optional and not essential to the successful practice of the process of the invention.

After the desired number of colour coats have been thus lithographically applied, the printed stock is allowed to dry, and then the scratch-off hiding coat is applied lithographically to the "hidden message" area. Drying of the colour coats normally takes from 6–24 hours, so that the hiding coat application is conveniently conducted the following day. The hiding coat, for formulation previously described, is lithographically applied over the "hidden message" area, in one, two or three wet-on-wet applications using a standard lithographic plate and printing machine. Then the hiding coat is dried. It is found that the hiding coat successfully adheres to the coating over the "hidden message" so as to render it undecipherable, and is sufficiently adhesive and durable to withstand normal handling and transportation of the printed stock. Nevertheless, it can be readily scratched off, to reveal the "hidden message" through the coating of the second colour.

The varnish-ink formulation is as previously described, merely including a suitable amount of a suitable pigment in addition to the previously mentioned ingredients.

With regard to the curing and the drying of the pigmented varnish-ink, it has additionally been found that the pigmented varnish-ink can be cured in a minimum amount of time. Curing and drying of a pigmented varnish under an infra-red energy source can be completed in as little as 30 minutes. This provides additional time savings for operations of this type.

In order to formulate the pigmented varnish of the present invention, 15–25% of the normal pigment (ink) vehicle usually employed in lithographic printing, is substituted by the varnish identified above. The varnish may be substituted in any colours of ink in order to formulate the pigmented varnish. In this way, a large number of colours may be used to print the message and any other pattern required on the card. A number of layers of differently coloured pigmented varnishes may be applied in sucession, in order to print a multi-coloured pattern and/or message on the card. It is, of course, necessary that in such cases, the colour of the second layer and any additional layer be chosen so as to maintain visibility of the message printed by the first layer.

In formulating the pigmented varnish, the extent of the varnish substitution for normal ink vehicle is dependent on the colour sequence used in the printing process. It is most desirable that the uppermost layer of pigmented varnish contains a higher percentage of the varnish than the lower layers so as to provide optimum communication between the pigmented varnish and the hiding layer.

The following is a preferred general formulation for the pigmented varnish-ink for use in the present invention. The amounts of ingredients are expressed as parts by weight:

Components	% Range
Magie oil (paraffin based solvent)	20-28
Phenolic modified rosin ester	14-18
Hydrocarbon resin (e.g. of the PICCOPALE* type)	8-12
Linseed isophthalic alkyd	6-10
Hydrocarbon plasticizer (e.g. of the DUTREX* type)	6-8
Isophorone diamine	0.5-1.5
Texanol isobutyrate	2-5

-continued

Components	% Range
Montan wax	2-5
Calcium perborate	1-3
Manganese octoate	1-2
Cobalt octoate	0.5-1
Gelling agent	0.3-0.6
Chinawood oil	0.3-0.5
Pigment	16-25

*Trade Marks

It should be noted that the pigmented varnish may also be prepared by mixing known inks of desired colour directly with the varnish. In this case, it will be evident that dilution of the pigment will result. Additional pigment may be added to retrieve the original intensity of the ink, if desired.

Preferably, the hiding coat contains pigments or opacifying agents which render the finished coat not only visibly opaque but also opaque to all other forms and wavelengths of radiation also, so that the "hidden message" cannot be prematurely revealed e.g. by x-rays, UV light etc. For this purpose the the hiding coat formulation should contain a powdered metal such as carbon black, dyes etc.

A suitable such hiding coat is as follows, with the amounts of ingredients expressed as percentages by weight:

Components	% Range
Titanium dioxide	28-35
Aluminum powder	15-20
Phenolic modified rosin ester	15-18
Linseed oil refined	9-11
Black pigment (carbon black)	7-8
Linseed-isophthalic alkyd	5-8
Magie solvent	5-7
Cobalt octoate	0.5-1
Chinawood oil	0.5-1
Hydrocarbon resin	0.5-1
Polyethylene wax	0.3-0.5
Fischer-Tropsch wax	0.2-0.5
Gelling agent	0.5-1

The hiding coat formulations for use in the present invention may be the same as described above or may contain an additional ingredient. It has been found that incorporation of one or more species of long chain fatty amides, of which may be mentioned erucamide, erucyl stearamide and erucyl erucamide, will improve the scratch-off properties of the hiding coat without impairing its integrity during the normal handling and storage. Incorporation of the long chain fatty amides with the above mentioned hiding coat formulation in a preferred range of about 10–20% by weight has been found to provide easier removal thereof by abrasion by the user and improved clarity of the uncovered message.

It will be noted that the above hiding coat formulation has the same basic resin system and solvent as the clear varnish or the pigmented varnish-ink formulation. It differs, however, in the amount of solvent and hence consistency, in the amount of curing system, and in the presence of opacifying agents of those mentioned in the specific formulations. Other suitable unsaturated oils may be used instead of linseed oil, and instead of chinawood oil. The gelling agent is as described in connection with the pigmented varnish-ink coat. The presence of some such unsaturated oil is highly advantageous in providing the best "scratch-off" properties. The lin-

seed-isophthalic alkyd resin in both the formulations is represented of a large variety of available such materials, and substantially any other unsaturated alkyd could be used instead. Isophthalics are preferred however.

The pigmented varnish-ink coat is suitably applied to a printed card stock by sheet fed or web lithograph methods. The aforementioned formulations are most suitable for sheet fed lithography. The consistency of the formulations needs adjustment to render them more suitable for web lithography.

The pigmented varnish-ink layers, suitably 2-4 in number, wherein each layer may be the same or a different colour, may be applied wet-on-wet, i.e. without waiting for the previously applied layer of pigmented varnish to dry and cure. The total pigmented varnish coat must however, as mentioned, be dried and cured before the hiding coat is applied. Then the hiding coat is also suitably applied to the stock, over the pigmented varnish, in one or several wet-on-wet layers, and then allowed to dry and cure.

The resulting hiding coat is durable not only to withstand normal storage and handling, but also to receive further overprintings and additional hiding layers, patterns or printed information, should this be required. The scratch-off portion can be readily removed by the user's fingernails, without abrasives, coins, files, erasers or the like, to show clearly the overprinted "hidden message".

The invention is further illustrated in the following specific examples.

EXAMPLE

The following specific pigmented varnish-ink formulation (a red ink) and hiding coat formulation were made up, with ingredients listed as weight percentages:

Red Varnish-Ink Formulation

Components	%
Magie oil (paraffin based solvent)	25
Phenolic modified rosin ester	15
Hydrocarbon resin (e.g. of the PICCOPALE* type)	14
Linseed isophthalic alkyd	8
Hydrocarbon plasticizer (e.g. of the DUTREX* type)	6
Isophorone diamine	1
Texanol isobutyrate	4
Montan wax	3
Calcium perborate	2.2
Manganese octoate	0.3
Cobalt octoate	0.5
Gelling agent	0.5
Chinawood oil	0.5
Pigment (Permanent Carmine FBB02 (CI, 12485)	20

*Trade Marks

Hiding Coat Formulation

Components	%
Titanium dioxide (TIOXIDE*)	32
Aluminium powder	18
Phenolic modified rosin ester	16
Linseed oil refined	10
Black pigment (carbon black)	8
Linseed Isophthalic alkyd	5
Magie solvent	6
Cobalt octoate	0.6
Chinawood oil	0.6
hydrocarbon resin (PICCAPOLE* Type)	1
Polyethylene wax	0.3
Fischer-Tropsch wax	0.3

-continued

Hiding Coat Formulation

Components	%
Gelling agent	0.6

*Trade Marks

The red varnish-ink formulation was applied, by sheet fed lithographically using a standard printing machine, to a card stock bearing indicia previously printed with a standard black ink known for use in lithographic printing. The card contained an area with a printed message which was to be hidden. The carmine pigmented-ink formulation was applied lithographically over the message area such that the entire message was covered by a solid rectangular block of the red varnish-ink. The message was clearly visible and legible through the red varnish-ink coat. The applied red varnish-ink coat was allowed to dry and cure for one way.

Next, using the same sheet fed lithographic printing machine, the hiding coat was applied directly over the cured varnish-ink coat. Four layers were applied, wet on wet, and then the hiding coat was allowed to dry.

The hiding coat so formed completely obliterated the underlying message. It was durable enough to withstand normal handling and packaging. Nevertheless, it was removable by scratching with a fingernail, to reveal the varnish coat substantially unaffected, through which the printed message was clearly visible.

EXAMPLE 2

By replacing the carmine pigment component in the varnish-ink formulation of example 1, black pigmented, yellow pigmented, and blue pigmented varnish-ink were prepared. The carmine varnish-ink was also prepared as per example 1.

Using the black-pigmented varnish-ink, a first layer was printed on a black substrate by a sheet-fed lithographic press having four printing stations in serial arrangement. This first black layer marked characters on the blank substrate including the indicia which were to be hidden, i.e. the "message".

The indicia-bearing substrate was passed, while still "wet" to a second pressing station on the same lithographic press where the carmine pigmented varnish-ink was applied such that the entire area encompassing the message was covered or "masked" by the carmine ink-varnish. Other areas were printed on the substrate at this same station and with the same carmine pigmented varnish-ink in this printing step in order to add colour to the characters on the card outside the area containing the message. The masking provides a surface over the message which enables the hiding layer to be reversibly trapped within the area of the masking. The message was clearly visible and legible through the carmine layer.

A third layer of yellow-pigmented varnish-ink was then applied at the next station on the same lithographic press to the substrate on areas outside of the message area. This additional layer served to add colour to the characters on the face of the card.

To provide an even more colourful card the substrate was passed from the yellow-pigmented printing station to the fourth and final printing station on the press where the blue-pigmented varnish-ink was appropriately layered on areas outside the message area.

Although it is within the scope of the invention to apply either or both of the yellow and blue-pigmented

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varnishes into the masked area at the subsequent printing stations it will be realized that, since the carmine layer i.e. the first masking layer will fulfill the aforementioned requirements of releasably trapping the hiding layer, savings on ink consumed in the printing process can be obtained by omitting the application of more than one blocking layer.

After the final fourth layer was printed, the substrate was removed and allowed to cure until the next day. Means for reducing the curing time can be used to accelerate the curing process, if desired, such as an infra red energy source, etc.

The substrate with the cured varnish-ink layers was then introduced into a lithographic press having, again, four printing stations, each of which contained a hiding coat formulation as exemplified in example 1. The hiding coat was applied directly over the carmine pigmented area blocking the message at each successive station.

The layers were applied wet-on-wet. After passing through the press the card was removed and allowed to dry.

The following day, it was found that the hiding coat layer was completely removeable to reveal the hidden message by scratching with a fingernail.

EXAMPLE 3

The following specific varnish-formulation and the hiding coat formulation of example 1 were made up, with ingredients listed as weight percentages:

VARNISH	
Components	%
Magie oil (solvent)	32
Phenolic modified rosin ester	18
Hydrocarbon resin (e.g. of the PICCOPALE* type)	16
Linseed isophthalic alkyd	10
Hydrocarbon plasticizer (e.g. of the DUTREX* type)	8
Montan wax	3.5
Calcium perborate	2.2
Manganese octoate	
Cobalt octoate	0.7
Gelling agent	0.5
Chinawood oil	0.7

*Trade Mark

The varnish formulation was applied, by sheet fed lithography using a standard printing machine, to a card stock previously printed with a message to be hidden. Three layers of applied varnish were applied successively, wet-on-wet and then the applied varnish was allowed to dry and cure. A light coloured, transparent film was formed, through which the underlying printed message was clearly visible and legible.

Next, using the same sheet fed lithographic printing machine, the hiding coat was applied over the cured varnish coat. Four layers were applied, wet-on-wet, and then the hiding coat was allowed to dry.

The hiding coat so formed completely obliterated the underlying message. It was durable enough to withstand normal handling and packaging. Nevertheless, it was removable by scratching with a fingernail to reveal the varnish coat substantially unaffected, through which the printed message was clearly visible.

Whilst according to the invention, it is preferred to apply the varnish-ink coat and the hiding coat lithographically, it is nevertheless possible to apply the varnish-ink coat by letterpress application and the hiding coat lithographically, thus retaining the principle advantage, of avoiding silk screen application. In such case, the hydrocarbon resin component is omitted from the varnish-ink formulation.

I claim:

1. A varnish composition suitable for lithographic application to a substrate to cover indicia printed thereon preparatory to hiding said indicia with an abrasively removable hiding coat, said composition including the following ingredients in the following approximate weight range:

Components	% Range
Magie oil (solvent)	30–35
Phenolic modified rosin ester	16–20
Hydrocarbon resin	13–17
Linseed-[isophtholic] isophthalic alkyd	10–13
Hydrocarbon plasticizer	7–10
Montan wax	3–6
Calcium perborate	1.5–3
Maganese octoate	1.5–2
Cobalt octoate	0.5–1
Gelling agent	0.5–0.7
Chinawood oil	0.3–0.5

2. A pigmented varnish-ink composition suitable for lithographic application to a substrate to cover indicia printed thereon preparatory to hiding said indicia with an abrasively removable hiding coat, said composition including the following ingredients in the following approximate weight range:

Components	% Range
Magie oil (paraffin based solvent)	20–28
Phenolic modified rosin ester	14–18
Hydrocarbon resin	8–12
Linseed-isophthalic alkyd	6–10
Hydrocarbon plasticizer	6–8
Montan wax	2–5
Calcium perborate	1–3
Manganese octoate	1–2
Cobalt octoate	0.5–1
Gelling agent	0.3–0.5
Chinawood oil	0.3–0.5
Pigment	16–25

3. A hiding coat composition suitable for lithographic application over a cured varnish coating as claimed in claim 1, and including the following ingredients in the following approximate weight ranges:

Components	% Range
Titanium dioxide	28–35
Aluminum powder	15–20
Phenolic modified rosin ester	15–18
Linseed oil refined	9–11
Black pigment (carbon black)	7–8
Linseed-isophthalic alkyd	5–8
Magie solvent	5–7
Cobalt octoate	0.5–1
Chinawood oil	0.5–1
Hydrocarbon resin	0.5–1
Polyethylene wax	0.3–0.5
Fischer-Tropsch wax	0.2–0.5
Gelling agent	0.5–1

4. A hiding coat suitable for lithographic application over a cured pigmented varnish-ink composition according to claim 2, and including the following ingredients in the following approximate weight range:

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Components	% Range
Titanium dioxide	28–35
Aluminum powder	15–20
Phenolic modified rosin ester	15–18
Linseed oil refined	9–11
Black pigment (carbon black)	7–8
Linseed-isophthalic alkyd	5–8

-continued

Components	% Range
Magie solvent	5–7
Cobalt octoate	0.5–1
Chinawood oil	0.5–1
Hydrocarbon resin	0.5–1
Polyethylene wax	0.3–0.5
Fischer-Tropsch wax	0.2–0.5
Gelling agent	0.5–1

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United States Patent [19]

Ito et al.

[11] **Patent Number: 4,569,306**

[45] **Date of Patent: Feb. 11, 1986**

[54] **VARNISH COATER FOR PRINTED PRODUCT**

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[58] **Field of Search** .... 118/46, 249, 203, 262, 118/236; 101/350, 351, 352, 416 B

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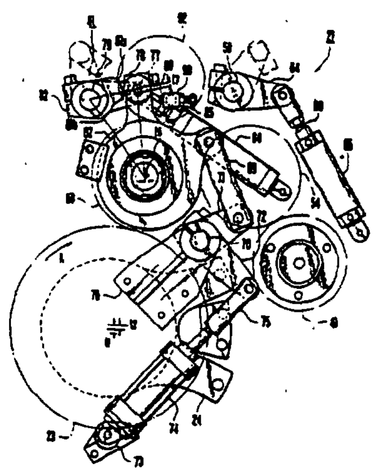
[57] **ABSTRACT**

In a varnish coater, a set of a blanket cylinder and a form roller and a set of a pan roller and a metering roller are driven by different drive sources. One-way clutches are arranged between the blanket cylinder and the form roller and between the form roller and a motor as one of the different drive sources, respectively. The form roller is selectively driven by one of the different drive sources through a corresponding one-way clutch. Alternatively, the form roller is driven by one of the drive sources which has a higher rotational speed.

5 Claims, 8 Drawing Figures



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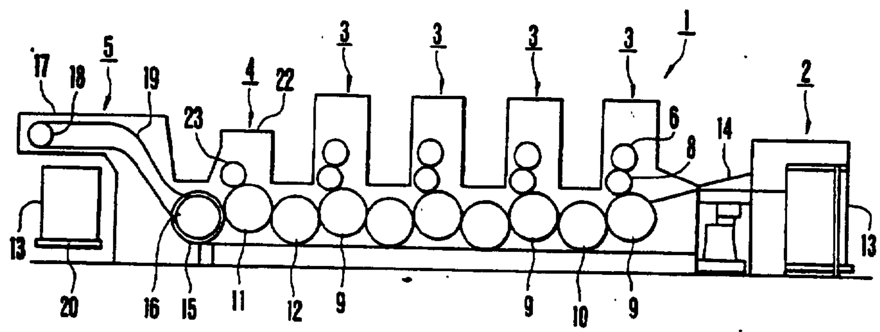
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FIG.1

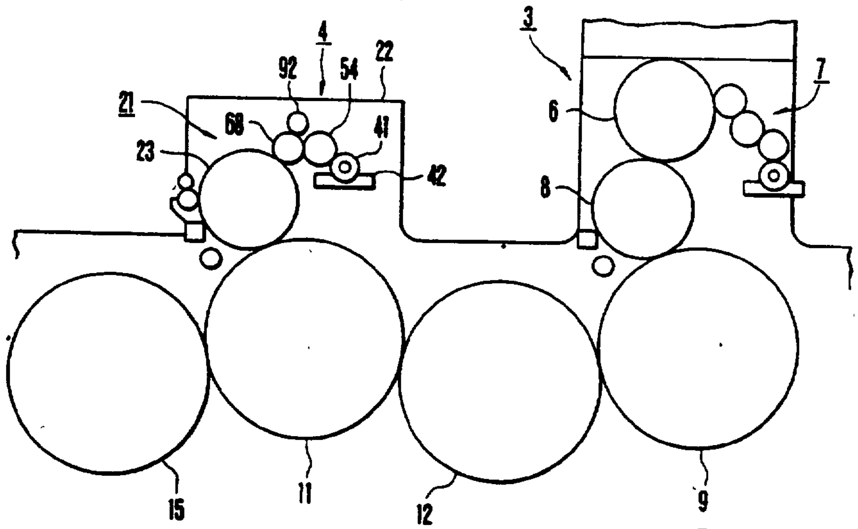
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FIG.2

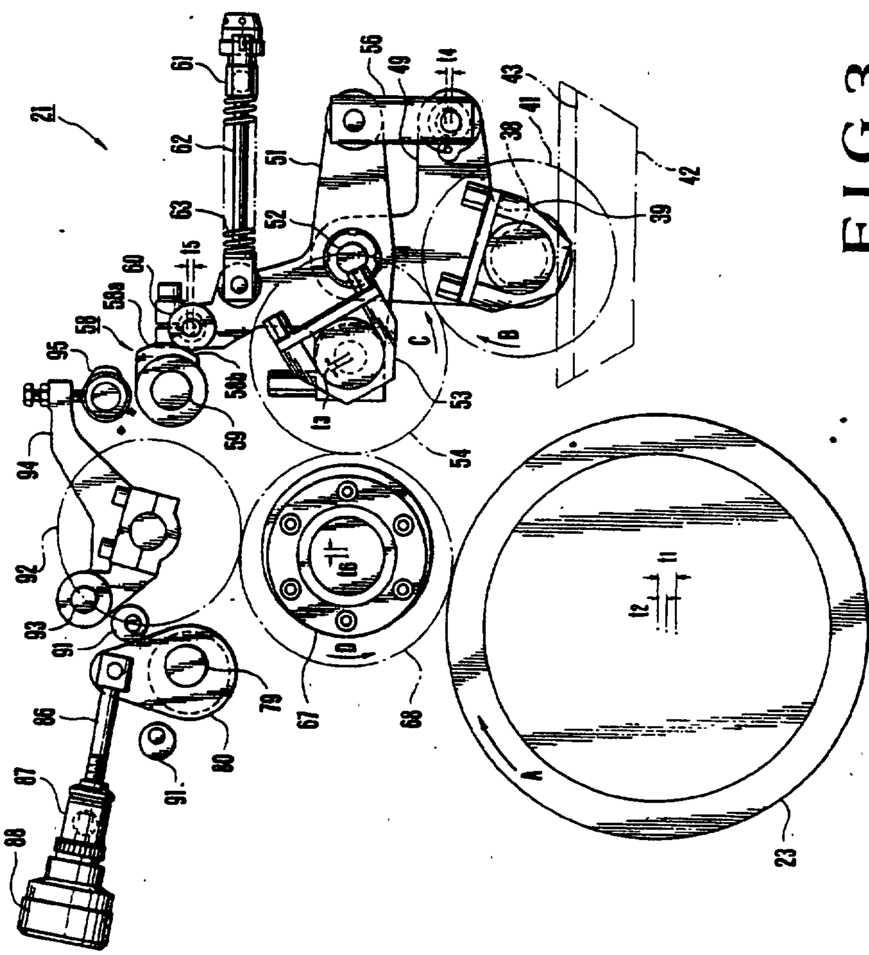


FIG.3

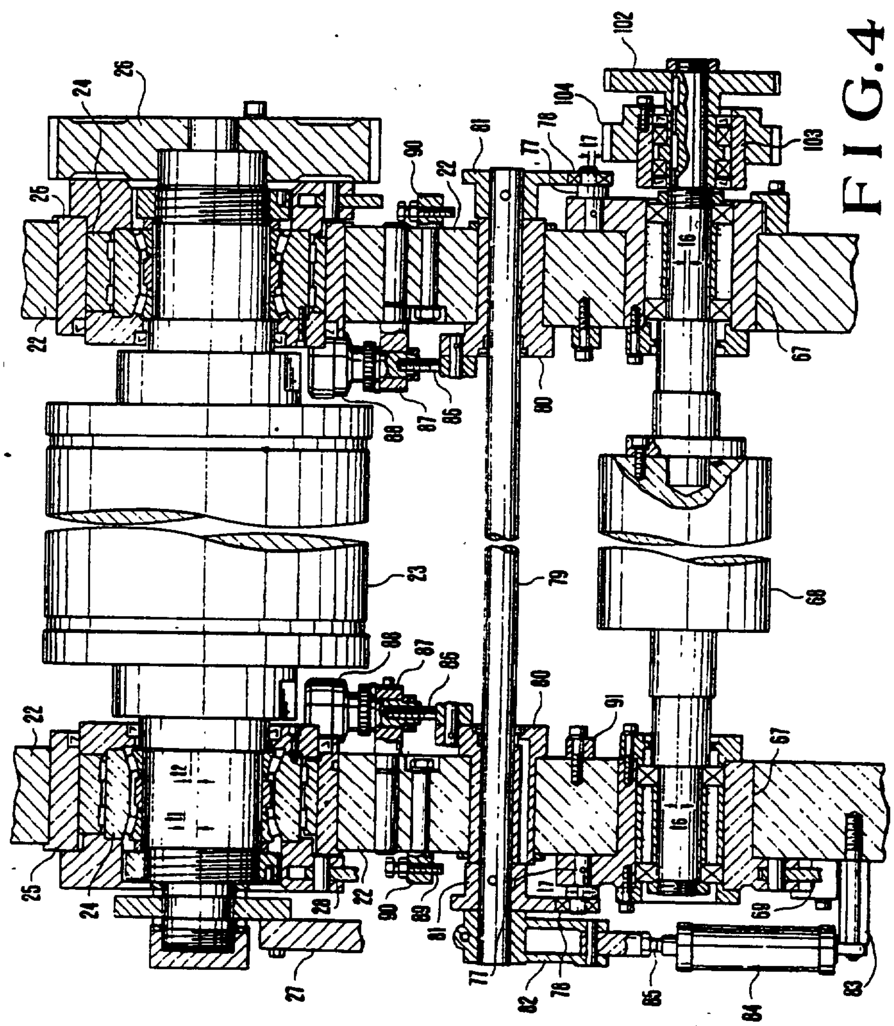


FIG.4

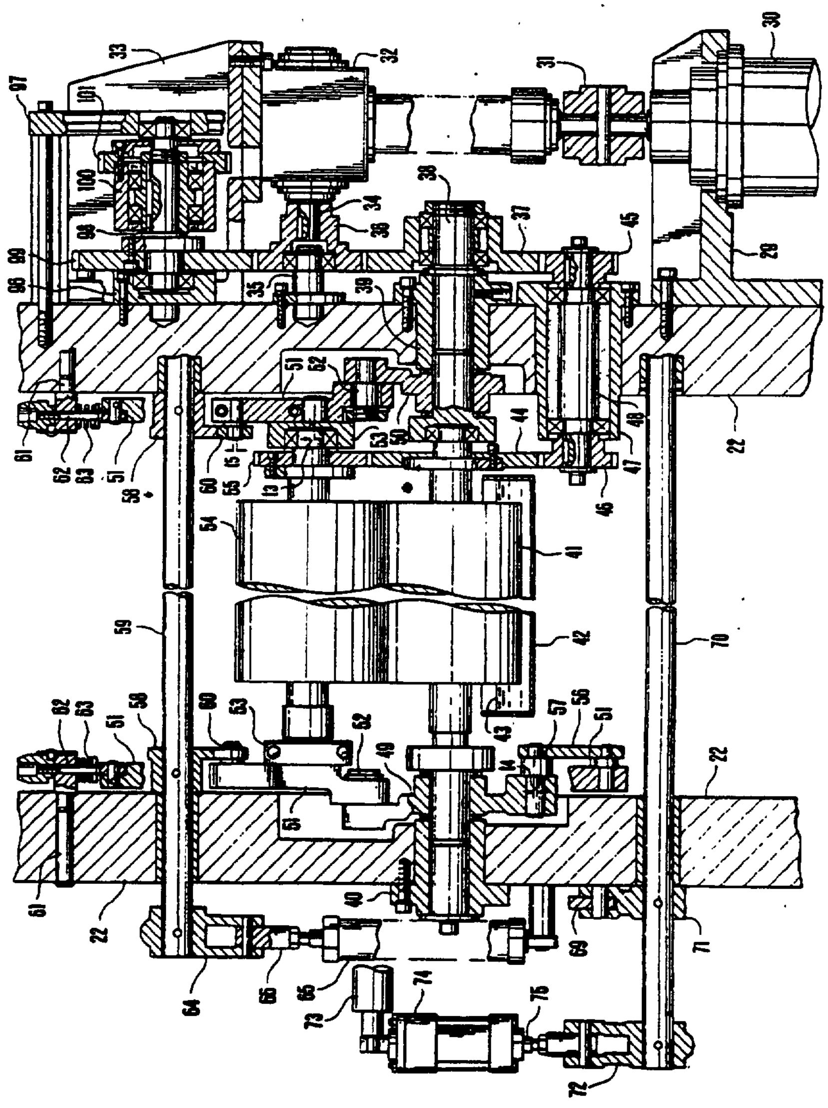
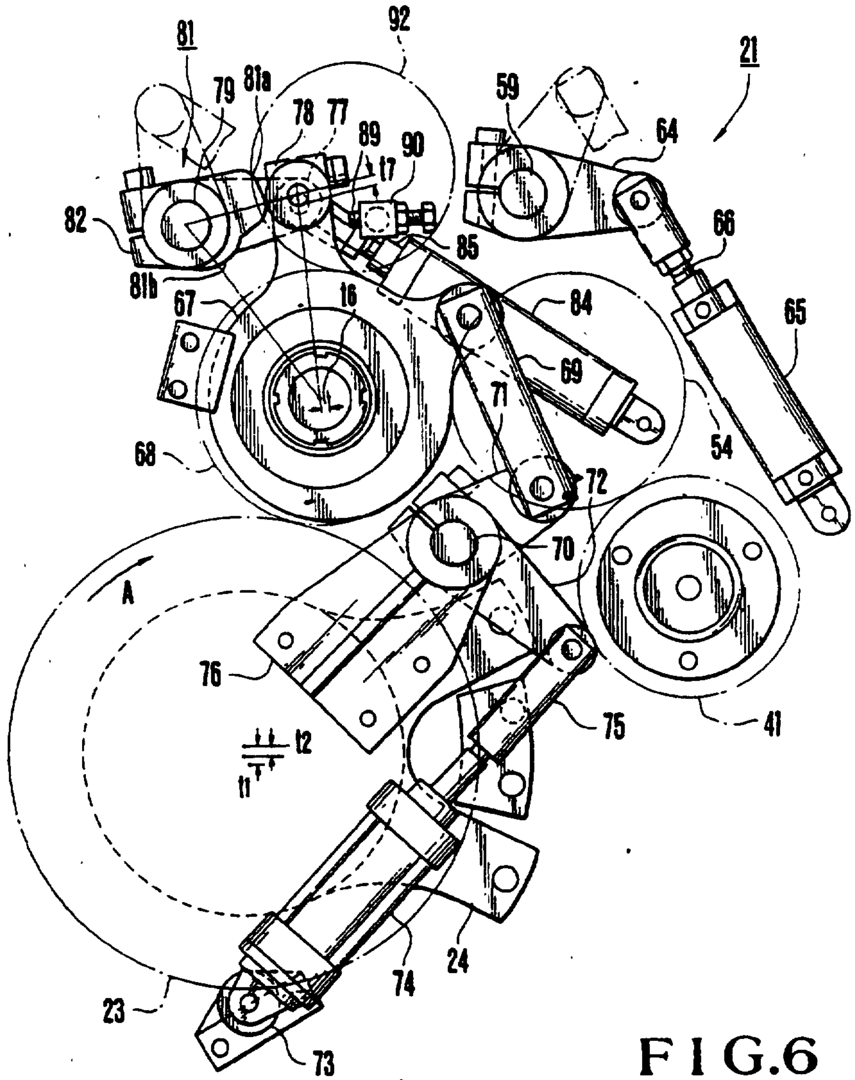


FIG.5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A
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t2
t1
24
74
23
73

FIG.6

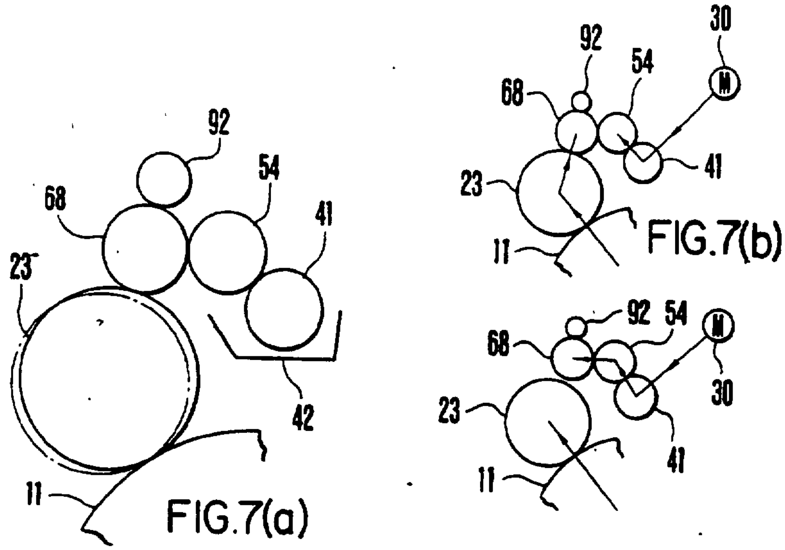

FIG.7(a)
FIG.7(b)
FIG.7(c)

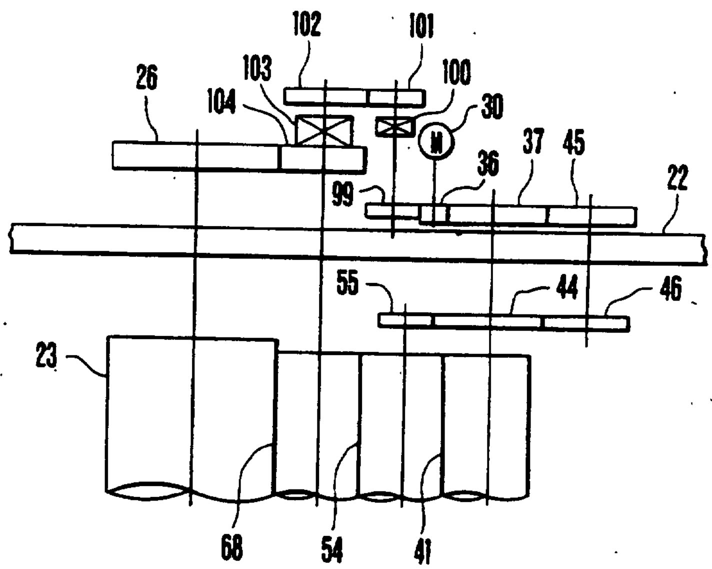

FIG.8

VARNISH COATER FOR PRINTED PRODUCT

BACKGROUND OF THE INVENTION

The present invention relates to a varnish coater disposed between a printing unit and a delivery apparatus of a rotary press or in an independent coating unit to apply varnish on a printed surface.

The surface of paper printed by a rotary printing press is not quickly dried and can be contaminated in the subsequent processing. In a sheet-fed rotary printing press, offsetting tends to be caused when printed sheets are stacked. In order to solve these problems, conventionally, a dryer is arranged in a delivery path of the printed products, or a powder is sprayed on the printed paper surfaces. However, in this case, the dryer becomes large, and powder spraying results in surface roughening of the printed surface. Surface roughening tends to entail a loss of gloss and subsequent poor printing. Instead of these techniques, varnish is applied to the printed surface to prevent the surface from being contaminated and to give it gloss. Varnishing is performed in printed products such as covers of books, catalogs and pamphlets which require an aesthetic effect.

The varnish coater is used as an independent apparatus. However, recently, the varnish coater is generally disposed in a delivery path of a printing press to shorten a coating time and an associated operation time for restacking the printed sheets and hence to improve the coating efficiency. The varnish coater generally has rollers in the same manner as that of a dampening apparatus for dampening a surface of a plate mounted on a plate cylinder of the printing unit. Varnish stored in a varnish pan is supplied to a surface of a blanket cylinder through the rollers. The varnish is transferred to a sheet passing between the blanket cylinder and an impression cylinder.

However, in the conventional varnish coater of this type, there arise problems in respect to a rotation transmission mechanism of each roller and a nonuniform thickness of a varnish film caused thereby. The printing press is stopped when the sheets are restacked, or a stack board is replaced, or an underlay for a blanket of the blanket cylinder is adjusted due to a change in paper size. In such a case, the blanket cylinder is separated from the impression cylinder, while the rollers used for applying varnish continue to rotate to prevent varnish from hardening before the restart time.

It is occasionally required that the blanket cylinder be driven from the drive line side of the press, and that the rollers consisting of a pan roller (upsteam roller), a metering roller and a form roller be driven by another variable motor so as to adjust the thickness of a varnish film. When the above operation is performed, however irregular rotation occurs between the blanket cylinder and the form roller which are driven by the different drive sources, thus resulting in an irregular thickness of the varnish film. However, when the form roller is coupled to the blanket cylinder through a gear, the form roller must be stopped when the blanket cylinder is stopped for cleaning and adjustment of the underlay of the blanket. As a result, the varnish on the outer surface of the form roller is hardened, and the form roller must also be cleaned, resulting in inconvenience.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a varnish coater capable of preventing irregular rotation between a blanket cylinder and a form roller to obtain a uniform thickness of a varnish film and hence to improve quality of printed products.

It is another object of the present invention to provide a varnish coater capable of preventing varnish on the form roller from being hardened while the blanket cylinder is stopped.

It is still another object of the present invention to provide a varnish coater capable of simultaneously cleaning the blanket cylinder and the form roller.

It is still another object of the present invention to provide a varnish coater capable of minimizing wasted paper by separating the blanket cylinder from the form roller to check varnishing, thereby improving the coating efficiency.

It is still another object of the present invention to provide a low-cost varnish coater which eliminates a need for electrical control, thereby simplifying maintenance procedures and preventing erroneous operation.

In order to achieve the above and other objects of the present invention, there is provided a varnish coater for a printed product, comprising:

upstream rollers for picking up and metering varnish;

a form roller which is brought into contact with one of the upstream rollers to receive the varnish therefrom;

a blanket cylinder which is selectively brought into contact with the form roller and an impression cylinder;

a main drive source for driving the impression cylinder and selectively driving the form roller;

a subdrive souce for driving the upstream rollers and selectively driving the form roller;

first and second one-way clutches arranged between the blanket cylinder and the form roller and between the form roller and the subdrive source, respectively; and

a gear mechanism for selectively transmitting a rotational force to the form roller.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic side view of a four-color sheet-fed offset rotary printing press;

FIG. 2 is a schematic side view of a fourth color printing unit and a coating unit of the rotary printing press shown in FIG. 1;

FIG. 3 is a side view of a varnish coater of the coating unit shown in FIG. 2 according to an embodiment of the present invention;

FIG. 4 is a developed sectional view of a portion including a blanket cylinder and a form roller of the varnish coater shown in FIG. 3;

FIG. 5 is a developed sectional view of a portion including a pan roller and a metering roller of the varnish coater shown in FIG. 3;

FIG. 6 is a side view of a throw-on and -off mechanism for rollers in correspondence with the portion shown in FIG. 3 when viewed from the outside of the frame;

FIGS. 7a–7c are a representation for explaining roller driving; and

FIG. 8 is a schematic representation of a roller drive unit.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIGS. 1 and 2, a four-color sheet-fed offset rotary printing press 1 comprises a sheet feeder 2, four color printing units 3, a coating unit 4 and a deliv-

ery apparatus 5. These components are separately assembled and constitute the rotary printing press 1. Each printing unit 3 has a plate cylinder 6 having a printing plate thereon, an inking apparatus (not shown) for supplying a corresponding ink to the cylinder surface, and a dampening apparatus 7 for supplying dampening water to dampen the cylinder surface. A blanket cylinder 8 is brought into contact with each plate cylinder 6 on which an image is formed by utilizing the corresponding color ink and water. The image on the plate cylinder 6 is transferred to the blanket cylinder 8 upon relative rotation therebetween. In each printing unit 3, an impression cylinder 9 having a diameter twice that of the blanket cylinder 8 is brought into contact therewith. A transfer cylinder 10 having the same diameter as the impression cylinder 9 is sandwiched between adjacent impression cylinders 9 of the corresponding printing units 3. An impression cylinder 11 having a diameter twice that of a blanket cylinder 23 (having the same construction as the blanket cylinder 8) of the coating unit 4 is disposed to be in contact with the blanket cylinder 23 and at the same level as the other impression cylinders 9 of the printing units 3. A transfer cylinder 12 is sandwiched between the impression cylinder 9 of the fourth color printing unit 3 and the impression cylinder 11 of the coating unit 4. Paper sheets 13 stacked on the feed table of the sheet feeder 2 are taken up by a sheet pick-up device (not shown) and are fed one by one onto a feedboard 14. Each sheet 13 is gripped with grippers of the first color impression cylinder 9 by means of a swing gripper. The sheet 13 is printed by the blanket cylinders 8 with four colors while the sheet 13 is sequentially fed by the transfer cylinders 10 and the corresponding impression cylinders 9. The printed sheet is then gripped by grippers of the impression cylinder 11 and is wound therearound.

The delivery apparatus 5 comprises a delivery cylinder 15 which is brought into contact with the impression cylinder 11, and a pair of right and left sprockets 16 which are coaxially mounted on the delivery cylinder 15. Delivery chains 19 each having grippers at equal intervals are respectively looped between the right and left sprockets 16 and front end sprockets 18 of a delivery frame 17. The sheet 13 gripped by the grippers of the impression cylinder 11 is gripped by the grippers of the chains 19 and transferred thereby. The sheet 13 is released from the grippers of the chains onto a stack board 20.

The coating unit 4 having the construction described above has a varnish coater 21 to be described below.

Referring mainly to FIG. 4, the blanket cylinder 23 having the same diameter as that of the blanket cylinder 8 is rotatably supported by right and left frames 22, respectively, through pairs of antifriction bearings 24 and plain bearings 25. The blanket cylinder 23 is rotated in the direction indicated by arrow A (FIG. 3) upon rotation of a cylinder gear 26 coupled to a driving source. The axes of the bearings 24 and 25 are respectively deviated by distances t1 and t2 with respect to the axis of the blanket cylinder 23. A lever 27 pivotally mounted on the corresponding rolling bearing 24 of the frame 22 is reciprocated by means of an air cylinder to bring the blanket cylinder 23 into contact with or separate it from the impression cylinder 11. A lever 28 pivotally mounted on the plain bearing 25 is reciprocated by a handle to adjust the contact pressure between the blanket cylinder 23 and the impression cylinder 11.

Referring mainly to FIG. 5, a DC variable motor 30 is supported and mounted on a bracket 29 fixed on the outer surface of one of the frames 22. A gear box 32 coupled to the shaft of the motor 30 through a coupling 31 is supported and mounted on a bracket 33 fixed on the outer surface of this frame 22. A driving gear shaft 34 is coupled to the motor shaft through a bevel gear which is disposed in the gear box 32 to be perpendicular to the motor shaft. A driving gear 36 supported by a stud 35 which extends outward from the frame 22 is fixed on the driving gear shaft 34. A gear shaft 38 is supported on the frame 22 through a bearing 39 to rotatably support an intermediate gear 37 meshing with the driving gear 36. One end of a pan roller 41 is rotatably supported by the bearing portion of the gear shaft 38 extending inwardly of the frame 22. The other end of the pan roller 41 is supported by a bearing 40 of the opposing frame 22. The pan roller 41 is dipped in varnish 43 stored in a varnish pan 42. A pan roller gear 44 is fixed on a collar in the vicinity of the gear shaft 38. Reference numerals 45 and 46 denote gears which respectively mesh with the intermediate gear 37 and the pan roller gear 44 to transmit a rotational force of the intermediate gear 37 to the pan roller 41. The gears 45 and 46 are mounted on a gear shaft 48 supported by a bearing 47 which is mounted on the frame 22. The pan roller 41 rotates in a direction indicated by arrow B (FIG. 3). L-shaped roller arms 49 and 50 (the shape of the roller arm 49 is illustrated in FIG. 3 in detail) are movably mounted between the collar of the pan roller 41 and the bearing 40 and between the collar of the gear shaft 38 and the bearing 39 through thrust bearings, respectively. Inverted T-shaped arms 51 (the shape thereof is illustrated in FIG. 3 in detail) are pivotally mounted through pins 52 on corresponding free ends of the L-shaped roller arms 49 and 50, respectively. A bearing 53 is pivotally mounted on the free end of each of the T-shaped arms 51 such that the axis of the bearing 53 is deviated by a distance t3 (FIGS. 3 and 5) with respect to the shaft of a metering roller 54 having an elastic surface. Therefore, the roller 54 is supported by the bearings 53 and is brought in contact with the pan roller 41. A gear 55 mounted on the end portion of the shaft of the roller 54 is meshed with the pan roller gear 44, so that the roller 54 is rotated in the direction indicated by arrow C (FIG. 3). Bolts are loosened to pivot the bearings 53 so as to adjust a nip pressure acting on the pan roller 41.

One of the roller arms 49 is coupled to the corresponding T-shaped arm 51 through a lever 56 having an eccentric portion indicated by a distance t4 (FIGS. 3 and 5). A pin 57 of the eccentric portion is manually pivoted to throw on/off the metering roller 54 with respect to the pan roller 41. Reference numeral 58 denotes cams each having a large diameter portion 58*a* (FIG. 3) and a small diameter portion 58*b* (FIG. 3). The cams 58 are mounted on end portions of a cam shaft 59 mounted across the right and left frames 22. These end portions are adjacent to the inner surface portions of the right and left frames 22, respectively. Rollers 60 eccentrically (indicated by a distance t5) mounted on the free ends of the T-shaped arms 51 are in contact with the cam surfaces of the cams 58, respectively. Pivotal spring shafts 62 are mounted on studs 61 extending inward from the frames 22. One end of each of pivotal spring shafts 62 is pivotally mounted on the corresponding T-shaped arm 51. The T-shaped arms 51 urge the rollers 60 which tend to abut against the cams 58 by

means of compression coil springs 63 mounted on the spring shafts 62, respectively. A piston rod 66 of an air cylinder 65 having an end mounted on the corresponding frame is pivotally coupled to the free end portion of a lever 64 fixed on the end of the cam shaft 59. When the piston rod 66 is moved to pivot the cams 58, the metering roller 54 can be brought into contact with or separated from the pan roller 41 through the rollers 60 and the T-shaped arms 51.

Referring again to FIGS. 3 and 4, eccentric bearings 67 (indicated by a distance t6 in FIG. 3) are respectively mounted on the frames 22 above the blanket cylinder 23. A form roller 68 is supported by the eccentric bearings 67 and is brought into contact with the blanket cylinder 23. As shown in FIG. 4, one end of a connecting lever 69 is coupled to an outwardly extended portion of one of the eccentric bearings 67, and the other end thereof is coupled to a lever 71 which is mounted on a lever shaft 70 mounted on the frame 22. An actuator end of a piston rod 75 of an air cylinder 74 pivotally coupled to the stud 73 extending outwardly from the frame 22 is coupled to a lever 72 fixed on one end of the lever shaft 70. When the piston rod 75 of the air cylinder 74 is moved to pivot the eccentric bearings 67 through the coupling lever 69 and the like, the form roller 68 can be thrown on/off with respect to the blanket cylinder 23. Referring to FIG. 6, reference numeral 76 denotes a bearing fixed on the bracket at the side of the frame 22 to support the lever shaft 70 outside the frame 22. As shown in FIG. 4, the roller shafts 77 are split-clamped to be pivoted. Inner rings of rollers 78 each comprising a ball bearing are respectively fixed at the eccentric portions deviated by distances t7 with respect to the axis of the roller shaft 77. Reference numeral 79 denotes a cam shaft supported by the right and left frames 22 respectively through eccentric bearings 80. As shown in FIG. 6, the position of the cam shaft 79 is preset such that the axes of the cam shaft 79, the roller 78 and the form roller 68 correspond to apexes of a right angled triangle. Cams 81 each having a large diameter portion 81*a* and a small diameter portion 81*b* are split-clamped on the cam shaft 79. In other words, the cams 81 are respectively pivotal about the eccentric bearings 80 through the cam shaft 79. A lever 82 is split-clamped on the projecting end of the cam shaft 79, and the actuator end of a piston rod 85 of an air cylinder 84 pivotally supported by the frame 22 through a stud 83 is pivotally coupled to the free end portion of the lever 82. Bolts 86 respectively extend from the extended portions of the eccentric bearings 80 which extend inside the frames 22. The bolts 86 respectively engage with nuts such that these bolts 86 are inserted in handles 88 supported by studs 87 so as not to move axially. When the handles 88 are turned to move the bolts 86 so as to turn the eccentric bearings 80, respectively, the cams 81 are eccentrically moved together with the cam shaft 79 to shift its axis. In this throw-on and -off mechanism of the form roller 68, when the piston rod 75 (FIG. 5) of the air cylinder 74 is shortened (i.e., when the eccentric bearings 67 are pivoted clockwise in FIG. 6), the form roller 68 is separated from the blanket cylinder 23. In this case, the eccentric direction of the bearings 67 is preset such that the form roller 68 is separated from the blanket cylinder 23 while the distance between the form roller 68 and the metering roller 54 is kept to be substantially constant. In the state shown in FIG. 6, the blanket cylinder 23 is in contact with the form roller 68. In this case, the piston rod of the air cylinder 84 is shortened, and the large diameter portion 81*a* of each cam 81 is in contact with the corresponding roller 78. The roller 78 is biased by an air pressure of the air cylinder 74 to abut against the corresponding cam 81. Furthermore, when the blanket cylinder 23 is removed and the form roller 68 is thrown on the blanket cylinder 23, the piston rod 85 of the air cylinder 84 is elongated to pivot the cams 81 counterclockwise. As a result, the rollers 78 are respectively brought into contact with the small diameter portions 81*b* of the cams 81 by means of the biasing force of the air cylinder 74. Therefore, the form roller 68 is held in a state wherein it contacts the blanket cylinder 23. In other words, in the throw-on and -off positions of the blanket cylinder 23, the contact forces of the form roller 68 with respect to the blanket cylinder 23 are limited by the large diameter portions 81*a* and the small diameter portions 81*b* of the cams 81. Adjustment of these contact forces is effected by the movement of the cam 81 caused by the turning of the handle 88. Referring to FIG. 4, reference numeral 89 denote off-position stoppers which are screwed in studs 90 on the frames 22, respectively. When the blanket cylinder 23 is located in the throw-on position, the piston rod 75 of the air cylinder 74 is shortened, and the eccentric bearings 67 are respectively pivoted until they abut against the stoppers 89. Therefore, the throw-off position of the form roller 68 can be defined with respect to the throw-on position of the blanket cylinder 23. Referring to FIG. 4, reference numeral 91 denotes stoppers for defining the eccentric pivotal movement of the cams 81 when the lever 82 respectively abuts against the stoppers 91. As shown in FIG. 3, a rider roller 92 is supported at each end thereof by an arm 94 pivotal about a pin 93 on the side of the frame 22 and is brought in tight contact with the form roller 68. The arm 94 swings upon pivotal movement of a cam 95 by means of a handle (not shown), so that the rider roller 92 can be thrown on/off with respect to the form roller 68.

The drive mechanism of the motor 30, the cylinder gear 26 and the form roller 68 will be described with reference to mainly FIGS. 7 and 8.

One end of a clutch shaft 98 is supported by a bearing 96 fixed on the frame 22 in the vicinity of the motor 30, and the other end thereof is supported by a bracket 97 extending from the frame 22. A gear 99 is fixed on the clutch shaft 98 and is meshed with the driving gear 36 to transmit rotation of the motor 30 to the clutch shaft 98. A clutch gear 101 fixed on a one-way clutch 100 (to be described in detail later) on the clutch shaft 98 is meshed with a form roller gear 102 fixed in the end portion of the roller shaft of the form roller 68. The one-way clutch 100 has a known structure capable of transmitting a rotational force in only one direction. In this embodiment, the form roller 68 is a driven member, so that the rotational force of the motor 30 is transmitted only to the form roller 68. A one-way clutch 103 having the same construction as the one-way clutch 100 is arranged in an end portion of a roller shaft of the form roller 68. A clutch gear 104 coupled to the one-way clutch 103 is meshed with the cylinder gear 26 of the blanket cylinder 23. In this case, the form roller 68 is the driven member for the one-way clutch 103, so that the rotational force of the blanket cylinder 23 is transmitted only to the form roller 68. In this manner, the form roller 68 is selectively driven by the motor 30 and the blanket cylinder 23 through the one-way clutches 100 and 103; the form roller 68 does not simultaneously receive the rotational forces through the one-way

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clutches 100 and 103. Either of the one-way clutches 100 and 103 which transmits a higher rotational speed is coupled to the form roller 68, and the other one of the one-way clutches 100 and 103 which transmits a lower rotational speed is decoupled from the form roller 68.

Referring to FIG. 7(*a*), the solid line position of the blanket cylinder 23 is defined as a throw-on position with respect to the form roller 68 and the impression cylinder 11. FIG. 7(*b*) shows a rotation transmission path when the blanket cylinder 23 is located in the throw-on position. In this case, the pan roller 41 and the metering roller 54 are driven by the motor 30, and the form roller 68 is driven by the impression cylinder 11 and the blanket cylinder 23 through the one-way clutch 103. Therefore, the one-way clutch 100 is decoupled from the form roller 68. Referring again to FIG. 7(*a*), the dotted line position of the blanket cylinder 23 is defined as a throw-off position with respect to the form roller 68. FIG. 7(*c*) shows a rotation transmission path when the blanket cylinder 23 is located in the throw-off position. In this case, the form roller 68 is driven by the motor 30 through the pan roller 41 and the metering roller 54 via the one-way clutch 100. Only the blanket cylinder 23 is driven by the impression cylinder 11. Therefore, the one-way clutch 103 is decoupled from the form roller 68.

The operation of the varnish coater 21 having the arrangement described above will now be described. The motor 30 of the varnish coater 21 is started to perform the coating operation while the blanket cylinder is located at the throw-off position. The cams 58 are pivoted by the air cylinder 65 to abut the rollers 60 against the small diameter portions 58*b* of the cams 58, respectively, so that the metering roller 54 is brought into tight contact with the pan roller 41 and the form roller 68 by means of the biasing forces of the compression coil springs 63. In this case, the piston rod 75 of the air cylinder 74 is elongated so that the rollers 78 of the eccentric bearings 67 are respectively brought into tight contact with the large diameter portions 81*a* of the cams 81. The form roller 68 is located in the throw-on position. However, since the blanket cylinder 23 is located in the throw-off position, the form roller 68 is separated from the blanket cylinder 23. In this case, the rotation of the motor 30 is transmitted to the pan roller 41 and the metering roller 54 through the bevel gears in the gear box 32, and the gears 36, 37, 45, 46, 44 and 55. The rotation of the motor 30 is also transmitted to the form roller 68 through the gears 36 and 99, the one-way clutch 100 and the gears 101 and 102. The blanket cylinder 23 is separated from the impression cylinder 11, and these cylinders are stopped. Upon rotation of the above-mentioned rollers, the varnish 43 is drawn by the pan roller 41 from the varnish pan 42. A thickness of the varnish film is adjusted upon contact between the pan roller 41 and the metering roller 54. The varnish film having a predetermined thickness is transferred to the form roller 68. Varnish circulates through the pan roller 41, the metering roller 54 and the form roller 68. When the rotary printing press is started to feed a sheet 13 onto the feedboard 14 by means of the automatic feeder 2, the blanket cylinders 8 of the printing units 3 are located in the throw-on positions, so that the sheet 13 is subjected to four-color process printing through the blanket cylinders and the corresponding impression cylinders 9. The printed sheet is fed toward the coating unit 4. When the printed sheet reaches the coating unit 4, the plain bearings 25 are pivoted in response to the command from a timing controller, so that the blanket cylinder 23 is located in the throw-on position, and that the blanket cylinder 23 is brought into tight contact with the impression cylinder 11 and the form roller 68. Varnish circulating between the form roller 68 and the pan roller 41 is transferred to the blanket cylinder 23 and is applied to the printed sheet passing between the blanket cylinder 23 and the impression cylinder 11. The coated sheet 13 is fed by the delivery chains 19 and is stacked on the stack board 20. In the throw-on position of the blanket cylinder 23, the rotational force is transmitted from the motor 30 to the form roller 68 through the one-way clutch 100. At the same time, since the blanket cylinder 23 is located in the throw-on position, the rotational force of the blanket cylinder 23 is transmitted to the form roller 68 through the gears 26 and 104 and the one-way clutch 103. The rotational speed of the blanket cylinder 23 is higher than that of the motor 30, so that only the rotational force of the blanket cylinder 23 is transmitted to the form roller 68. The one-way clutch 100 is decoupled from the form roller 68.

When the coating operation is completed and the stack board 20 of the delivery apparatus 5 is replaced with an empty stack board, or the underlay of the blanket is adjusted if the blanket becomes thin, sheet feeding is stopped. In this condition, the blanket cylinders 8 of the printing units are moved in the throw-off positions, and the blanket cylinder 23 is simultaneously thrown off with respect to the impression cylinder 11 and the form roller 68. In this case, the cylinder gear 26 is slightly meshed with the gear 104, and the motor 30 continues to rotate. Therefore, the form roller 68 continues to be driven by the blanket cylinder 23 through the one-way clutch 103. At the same time, the pan roller 41 and the metering roller 54 continues to be driven by the motor 30, so that the varnish 43 circulates in a path between the varnish pan 42 and the form roller 68 and will not be hardened. In the case of adjusting the underlay of the blanket of the blanket cylinder 23, the rotary printing press is stopped, and the blanket cylinder 23 is cleaned and the underlay is adjusted. In this case, the form roller 68 is driven by the motor 30 through the one-way clutch 100. After the underlay is adjusted, the rotary printing press is started. When the air cylinder 84 is actuated to elongate the piston rod 85, the cams 81 are rotated counterclockwise (FIG. 6) through about 90°. In this case, the eccentric bearings 67 are biased by the air cylinder 74 and are rotated until the rollers 78 respectively abut against the small diameter portions 81*b* of the cams 81. Therefore, the form roller 68 is brought into contact with the blanket cylinder 23 which is located in the off position, and the varnish under circulation is transferred to the blanket cylinder 23. The cylinder gear 26 is meshed with the gear 104, so that the form roller 68 is driven by the blanket cylinder 23 through the one-way clutch 103 at a speed higher than the rotational speed of the motor 30 since the rotation of the impression cylinder is transmitted through meshing between the gears 26 and 104 even if the blanket cylinder 23 is located in the throw-off position. Thereafter, when the sheet 13 is fed and reaches the blanket cylinder 23, the air cylinders 74 and 84 are actuated in response to predetermined timing signals from the timing controller. As a result, the rollers 78 are respectively brought into tight contacts with the large diameter portions 81*a* of the cams 81, and the blanket cylinder 23 is located in the throw-on position. Therefore, the form roller 68 is brought into tight contact with the blanket

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cylinder 23 by a contact pressure preset by the cams 81 and the rollers 78, thereby to restore the coating condition which existed before sheet feeding was stopped. In order to simultaneously clean the form roller 68 and the blanket cylinder 23, the form roller 68 is brought into contact with the blanket cylinder 23 which is located in the throw-off position. The form roller 68 is driven through the blanket cylinder 23. In addition, in order to manually clean the blanket cylinder 23, the blanket cylinder 23 is located in the throw-off position, and the impression cylinder 11 is stopped. The blanket cylinder 23 can be washed while the form roller 68 is located in the off state with respect to the blanket cylinder 23. Therefore, the form roller 68 is driven by the motor 30.

The present invention is not limited to the particular embodiment described above. It is essential to rotate the blanket cylinder in synchronism with the form roller. For example, the form roller 68 can be brought into tight contact with only the pan roller 41, and the metering roller 54 can be brought into tight contact with only the pan roller 41. The same effect as in the above embodiment can be obtained even in this modification. The rotational direction of the rollers is not limited to the way as described above.

As is apparent from the above embodiment, in the varnish coater for the printed product, the blanket cylinder and the form roller, and the rollers located in the upstream of the form rollers are driven by the separate drive sources. The one-way clutches are arranged between the blanket cylinder and the form roller and between the form roller and the upsteam drive source, respectively. The form roller is selectively driven by one of the blanket cylinder drive source and the upstream drive source. In addition, the form roller is driven by one of the drive sources which has a higher rotational speed. The form roller can be driven without damage irrespective of the throw-on and -off operation between blanket cylinder and the form roller. Therefore, the coating operation can be properly performed, varnish can be applied to the rollers while the blanket cylinder and the form roller are respectively located in the throw-off positions, and the varnishing operation can be checked while the blanket cylinder and the form roller are respectively located in the throw-off and throw-on positions. These operations can be performed without irregular rotation between the blanket cylinder and the form roller, thereby eliminating the nonuniform thickness of the varnish film and hence improving the quality of the printed products. In addition, while the blanket cylinder is stopped, the form roller can be continuously rotated together with the metering roller and the pan roller, thereby preventing hardening of varnish. Furthermore, varnishing can be checked while the blanket cylinder is located in the throw-off position, thereby decreasing occurrence of wasted paper and improving the coating operation. In addition to these advantages, the electrical control system is not required, so that a low-cost varnish coater can be obtained, the maintenance procedures can be simplified, and the erroneous operation can be eliminated.

What is claimed is:

1. A varnish coater for a printed product, comprising:
upstream rollers for picking up and metering varnish;
a form roller which is brought into contact with one of said upstream rollers to receive the varnish therefrom;
a blanket cylinder which is selectively brought into contact with said form roller and an impression roller;
a main drive source for driving said impression roller and selectively driving said form roller;
a subdrive source for driving said upstream rollers and selectively driving said form roller;
first and second one-way clutches arranged between said blanket cylinder and said form roller and between said form roller and said subdrive source, respectively; and
a gear mechanism for selectively transmitting a rotational force to said form roller;
wherein said subdrive source drives said form roller via a subdrive source gear, a first transfer gear meshed with the subdrive source gear, said second one-way clutch, a second transfer gear meshed with a form roller gear, and said form roller gear, when said blanket cylinder is separated from said form roller, said subdrive source gear, said first and second transfer gears and said form roller gear being included in said gear mechanism.

2. A varnish coater according to claim 1, wherein said main drive source drives said blanket cylinder through said impression cylinder, and said blanket cylinder drives said form roller through a blanket cylinder gear, a first one-way clutch gear meshed with said blanket cylinder gear and, said first one-way clutch when said blanket cylinder is held in a throw-on position, and said blanket cylinder gear, said first one-way clutch gear, being included in said gear mechanism.

3. A varnish coater according to claim 1, wherein said form roller is driven by one of said main drive source and said subdrive source which has a higher rotational speed.

4. A varnish coater according to claim 3, wherein said main drive source has a rotational speed higher than that of said subdrive source.

5. A varnish coater according to claim 1, wherein said upstream rollers comprise a metering roller and a pan roller, said pan roller being dipped in varnish.

* * * * *

W019321

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United States Patent [19]
Verwey et al.

[11] Patent Number: 4,574,732
[45] Date of Patent: Mar. 11, 1986

[54] OVERVARNISH UNIT

[75] Inventors: William G. Verwey, Phoenix, Md.; John C. Hovekamp, Burton, Ohio

[73] Assignee: Feco Engineered Systems, Inc., Cleveland, Ohio

[21] Appl. No.: 616,862

[22] Filed: May 29, 1984

Related U.S. Application Data

[63] Continuation of Ser. No. 491,715, May 5, 1983, abandoned.

[51] Int. Cl.[4] B05C 1/08; B05C 11/00
[52] U.S. Cl. 118/642; 118/46; 118/210; 118/224; 118/262; 118/608
[58] Field of Search 118/46, 210, 224, 262, 118/642, 608

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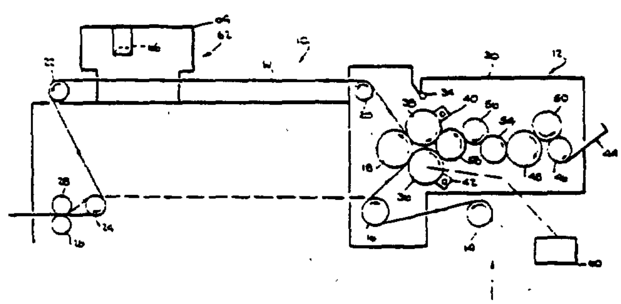
Primary Examiner—Evan K. Lawrence
Attorney, Agent, or Firm—Patrick J. Walsh

[57] ABSTRACT

Disclosed is an overvarnish unit for applying varnish to a web of printed material as a protective overlay. The overvarnish unit includes a varnish fountain for receiving paste varnish, a form roller, and a plurality of rollers intermediate the fountain and form roller. The form roller engages an impression cylinder roller forming part of a printing assembly. The varnish is transferred from the fountain to the form roller by the intermediate rollers which also mill the varnish as it is being transferred to reduce its viscosity. The form roller is driven at a peripheral speed greater than the linear speed of the web over the impression cylinder roller. This form roller overspeed provides a smearing action in applying the varnish to the web rather than a one to one or line by line printing action thus achieving control over the thickness of the applied varnish and the appearance of the final product.

6 Claims, 1 Drawing Figure



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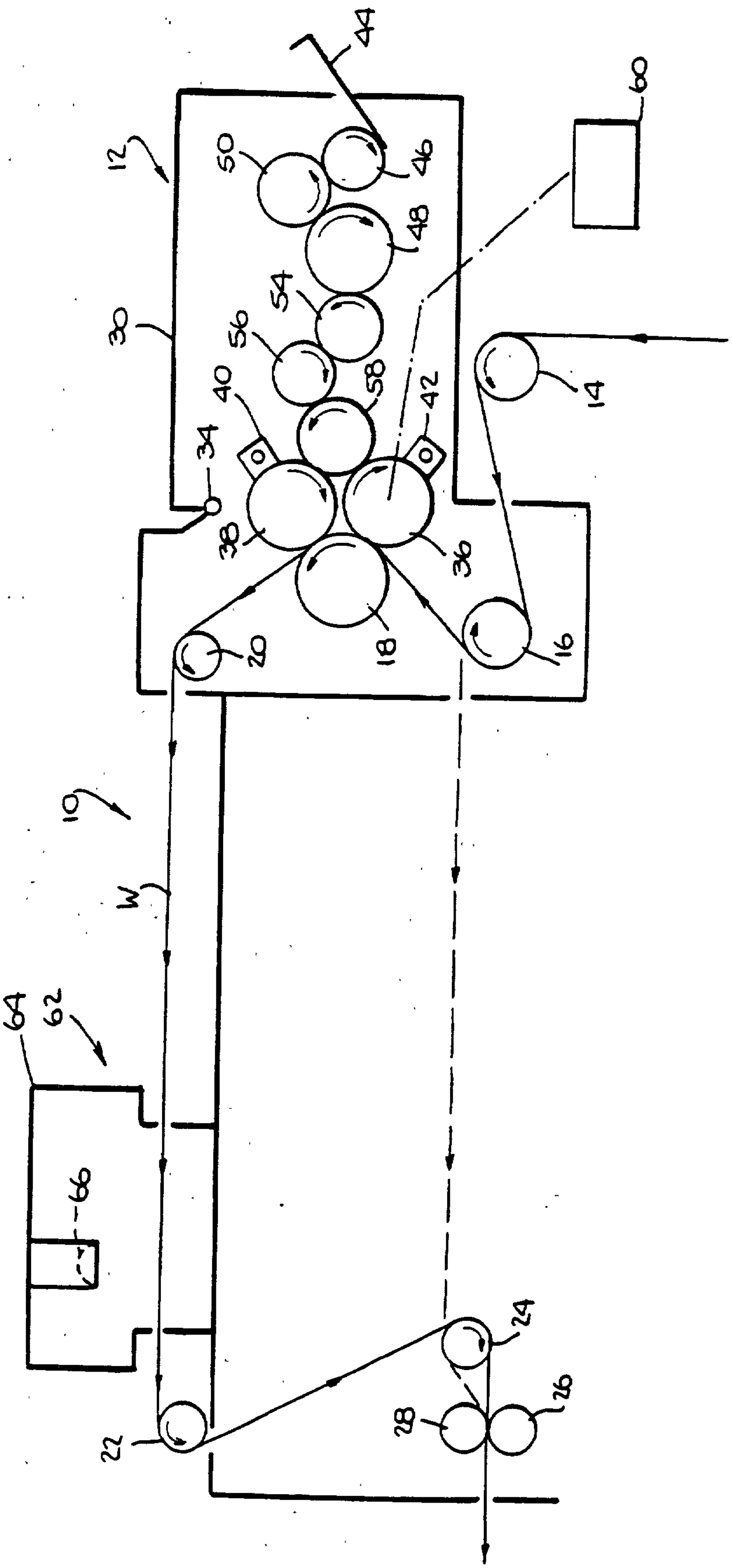
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OVERVARNISH UNIT

This is a continuation of application Ser. No. 491,715 filed May 5, 1983 abandoned.

BACKGROUND OF THE INVENTION

The present invention relates to an overvarnish unit for applying varnish to a web of printed material and particularly relates to an overvarnish unit for smearing varnish, for example paste varnish, onto a web of printed material in a manner enabling control over the thickness of the varnish deposited on the web and permitting the varnish to be applied to the web in a continuous rather than by a batch type process.

Overvarnishing is the application of a varnish overlay to printed material in the course of a printed process wherein the varnish serves as a protective coating to the printed material. Presently, this is accomplished by means of an ink station forming part of the printing press. That is, the printer will normally dispose a liquid varnish in an ink fountain at an ink station and the varnish will be deposited on the web similarly as if the web was being printed with ink. In conventional printing procedure, the peripheral speed of the printing roller is the same as the linear speed of the web. Thus, contact between the printing roller and the web is made momentarily; i.e., point to point or one line at a time. Stated differently, there is no relative movement between the printing roller and the web as the web passes over the roller. Hence control over the thickness of the varnish applied to the web and its final appearance cannot be maintained.

Further, most varnish coatings applied in conjunction with printing presses utilize a liquid varnish. This liquid varnish is provided in relatively large containers; e.g., five gallon drums. Overvarnishing, however, uses up the varnishing material at a rather rapid rate, particularly in the larger printing roller sizes; e.g., rollers ten, twelve and fourteen inches wide. Consequently, the supply of varnish must be replenished with great frequency; e.g., every two or three hours. This replenishment, however, requires the machine to be shut down. Accordingly, there has arisen a need for an overvarnish unit which minimizes or eliminates the foregoing and other problems associated with prior overvarnish units and which affords various advantages in construction, operation and end product.

SUMMARY OF THE PRESENT INVENTION

Accordingly, it is a primary object of the present invention to provide a novel and improved overvarnish unit wherein the thickness of the varnish applied to the web can be accurately controlled.

It is another object of the present invention to provide a novel and improved overvarnish unit wherein the varnish is applied by a smearing action rather than by a point to point or line to line contact between the printing roller and the web.

It is still another object of the present invention to provide a novel and improved overvarnish unit wherein the appearance of the final product; e.g., the printed material with the varnish overlay, is substantially improved.

It is a further object of the present invention to provide a novel and improved overvarnish unit wherein a paste type varnish may be utilized.

It is a related object of the present invention to provide a novel and improved overvarnish unit wherein the printing process may be continuous without the need to shut down the printing press to replace the supply of varnish.

To achieve the foregoing and other objects of the present invention and in accordance with the purposes hereof, as embodied and broadly described herein, an overvarnish unit for varnishing a web of printed material in accordance with the present invention may comprise a press assembly having a rotatable impression cylinder for receiving a web driven at a predetermined linear speed, a form roller in contact with the web on the impression cylinder, a varnish fountain, means for transferring varnish from the varnish fountain to the form roller, and means for driving the form roller at a peripheral speed different than the linear speed of the web over the impression cylinder enabling the varnish to be smeared onto the web.

In a preferred embodiment of the present invention, the drive means drives the form roller at a peripheral speed greater than the linear speed of the web over the plate cylinder. Also, the transfer means includes means for milling the paste varnish to reduce its viscosity for application to the web by the form roller.

The accompanying drawing, which is incorporate in and constitutes a part of this specification, illustrates a preferred embodiment of the present invention, and, together with the description, serves to explain the principles of the invention.

BRIEF DESCRIPTION OF THE DRAWING

The sole FIGURE is a schematic illustration of an overvarnish unit constructed in accordance with the present invention and illustrating the overvarnish unit dispensing rollers, printing assembly rollers and the web of printed material as it traverses the various rollers.

DESCRIPTION OF A PREFERRED EMBODIMENT

Referring now to the FIGURE, there is illustrated a press assembly, generally designated **10**, forming part of a printing press and an overvarnish unit therefor, generally designated **12**. A web of printed material, generally designated W, is also indicated by the solid lines bearing arrows, the arrows indicating the direction of movement of the web through the printing station. The dashed lines with the arrows indicate an arrangement of the web and its direction of movement through the press station **10** when the overvarnish unit **12** is not utilized.

From a review of the drawing FIGURE, it will be appreciated that web W is continuously fed into and through press assembly **10** from a prior printing station forming part of a press line, not shown. The web W immediately preceding press assembly **10** is fed through a festoon box, also not shown, for taking up slack in the web for machine arrangements in which the press has an indexing die cutter. Web W is fed over a pair of spaced take up rollers **14** and **16**. From roller **14**, web W extends about an impression cylinder roller **18** and then about a pair of longitudinally spaced rollers **20** and **22**. Web W then passes over a roller **24** and between a pair of rollers **26** and **28** for travel to further printing operations, not shown, for example cutters, etc. One or more of these rollers is driven by means, not shown, to drive web W along the rollers at a predetermined speed. Also web W is adapted to pass from roller **16** directly to

roller 24 in the event overvarnish unit 12 is not utilized; e.g., when varnish is not being applied thereby bypassing rollers 18, 20 and 22. This is indicated by the dashed line with arrows indicating the direction of web travel. It will be appreciated that rollers 14, 16, 18, 20, 22, 24, 26 and 28 are all suitably mounted on and form a part of the press assembly 10.

Turning now specifically to the overvarnish unit 12, unit 12 includes a housing 30 which is detachably mounted on the press assembly 10 by a pair of upwardly opening hooklike members on press assembly 10 which receive a bar 34 carried by unit 12. A pair of adjustable form rollers 36 and 38 are carried by housing 30 with at least one roller 36 engaging the impression roller 18 of the press assembly with the web W therebetween. Form rollers 36 and 38 are mounted on pivoted arms 40 and 42 carried by housing 30 and screws cooperate between housing 30 and arms 40 and 42 for adjusting the location of the rollers and their pressure vis-a-vis impression cylinder roller 18.

Varnish is supplied to the form rollers from a varnish fountain 44 by a series of transfer rollers. Particularly, varnish is fed to a fountain roller 46 in contact with the fountain 44. From fountain roller 46, varnish is transferred to a ductor roller 48, a nip roller 50 being disposed therebetween. A receiver roller 54 receives varnish from ductor roller 48 for transferring varnish to an idler roller 56 and an oscillating roller 58. Oscillating roller 58 engages form rollers 36 and 38 and thus transfers varnish onto web W passing between the form rollers and the impression cylinder roller.

In accordance with the present invention, the overvarnish unit 12 is designed particularly for handling and dispensing paste varnish. The paste varnish is supplied to the varnish fountain 44 by depositing it in paste form into fountain 44, for example by means of a spatula. The rollers between varnish fountain 44 and form rollers 36 and 38, in addition to transferring the varnish from the fountain to the form rollers, serve also as a mill for the varnish. That is, the varnish is worked by the various rollers of the overvarnish unit by rotating them at different speeds as the varnish is transferred to decrease its viscosity to a level sufficiently low for deposition on Web W. While the preferred form of the present invention utilizes paste varnish in the overvarnish unit, it will be appreciated that a liquid varnish may also be utilized with the overvarnish unit herein described. Because of the tendency of the paste varnish to set-up and "freeze" the bearings of the rollers of the overvarnish unit, special but conventional bearings that allow flushing with a solvent are provided for the rollers to maintain low friction values.

It is a particular feature of the present invention that the varnish is smeared onto the web 10 rather than applied by a printing action thus enabling control over the thickness of the applied varnish and also over the final appearance of the web. This smearing action may be analogized to a painting action; e.g., an application moving at a different speed than the surface receiving the application, rather than a point to point or line to line application as in a printing process. Particularly, form roller 36 and 38 are adjusted to run at a faster peripheral speed than the linear speed of web W. To accomplish this, the form rollers are driven by an independent D.C. drive motor 60, which is wired as a slave of the press drive, with a potentiometer controller for adjusting its speed. More particularly, the peripheral speed of the form roller is preferably about 10% greater

than the linear speed of the web W and should lie without a range of 1 to 2 times greater for optimum results. Thus, by running the form rollers overspeed, the varnish is smeared onto the web W and by controlling the overspeed relative to the speed of the web W, control over the thickness of the varnish applied to the web W and hence its final appearance is achieved.

A curing station 62 is provided if U.V. curable varnishes are used downstream of the overvarnish unit. Particularly, curing station 62 includes a housing 64 for an ultraviolet lamp 66. Lamp 66 is situated above web W on its varnished side as web W traverses printing assembly 10. Lamp serves to cure the varnish applied to web W.

In use, the linear speed of the web W passing over the rollers of the printing assembly is set. Paste varnish is supplied to the fountain 44 (the fountain meters the supply of varnish into the roller train) and the peripheral speed of the form rollers is set in excess of the linear speed of web W, depending on the desired thickness of the varnish overlay, by adjusting the controller. The varnish is thus transferred from fountain 44 to the form rollers by the various rollers of the overvarnish unit while simultaneously the rollers also mill the paste varnish to reduce its viscosity. Because the form rollers are at a peripheral speed greater than the linear speed of the web, the varnish is smeared onto the web at a controlled thickness. The web then passes through the curing station 62 where the applied varnish is cured by the ultraviolet lamp as the web moves along the printing assembly.

It will be apparent to those skilled in the art that various modifications and variations can be made in the overvarnish unit hereof without departing from the scope or spirit of the present invention.

What is claimed is:

1. An overvarnish unit for varnishing a web comprising:

- a press assembly having a rotatable impression cylinder for receiving a web driven at a predetermined linear speed,
- one or more form rollers in contact with the web on said impression cylinder,
- a varnish fountain,
- a fountain roller in contact with the fountain for receiving varnish therefrom,
- a plurality of willing rollers positioned in serial rolling contact with each other for transferring varnish from the fountain roller to the one or more form rollers and for milling the varnish as it is being transferred so as to reduce the viscosity of the varnish for ease of deposition on the web, and
- means for driving said one or more form rollers at a peripheral speed different than the linear speed of the web over the impression cylinder enabling the varnish to be smeared onto the web.

2. An overvarnish unit according to claim 1 wherein said driving means drives said form roller at a controllable peripheral speed greater than the linear speed of the web.

3. An overvarnish unit according to claim 1 wherein said varnish fountain is adapted to receive varnish in paste form.

4. An overvarnish unit according to claim 1 wherein said plurality of milling rollers rotate at different speeds in engagement with one another for working the paste varnish to reduce its viscosity.

5. An overvarnish unit according to claim 1 including an ultraviolet lamp carried by said press assembly disposed at a location downstream of said form roller for curing the varnish smeared onto the web.

6. An overvarnish unit according to claim 5 wherein said driving means drive said form roller at a peripheral speed greater than the linear speed of the web, and said varnish fountain being adapted to receive varnish in paste form.

* * * * *

W019327

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United States Patent [19]

Tokuno et al.

[11] Patent Number: 4,586,434

[45] Date of Patent: May 6, 1986

[54] DEVICE FOR REPLACING PLATE CYLINDERS

[75] Inventors: Masateru Tokuno, Nishinomiya; Tetsuya Sawada, Nishigyo; Hidetoshi Hoshiyama, Ibaraki; Toshihiro Yoneda, Takatsuki, all of Japan

[73] Assignee: Rengo Co., Ltd., Osaka, Japan

[21] Appl. No.: 729,348

[22] Filed: May 1, 1985

[30] Foreign Application Priority Data

May 17, 1984 [JP] Japan 59-100860

[51] Int. Cl.⁴ B41F 13/00

[52] U.S. Cl. 101/178; 101/219; 414/911

[58] Field of Search 414/911, 285, 279, 278; 82/DIG. 5; 29/568; 101/1, 216, 219, 178, 174

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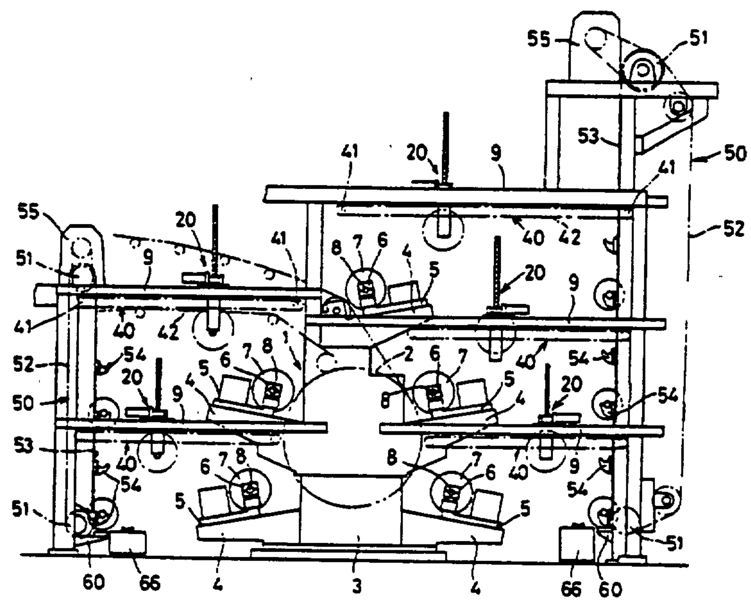
Primary Examiner—Clifford D. Crowder

Attorney, Agent, or Firm—Wenderoth, Lind & Ponack

[57] ABSTRACT

A device for replacing plate cylinders for a color rotary press is proposed which includes suspending units having a bearing adapted to support one end of the shaft of a plate cylinder and to be movable in a vertical direction, and travellers for moving the suspending units in a horizontal direction, and elevator conveyors having bearings secured to a chain to support one end of the shaft of the plate cylinder and move the latter up and down.

4 Claims, 8 Drawing Figures



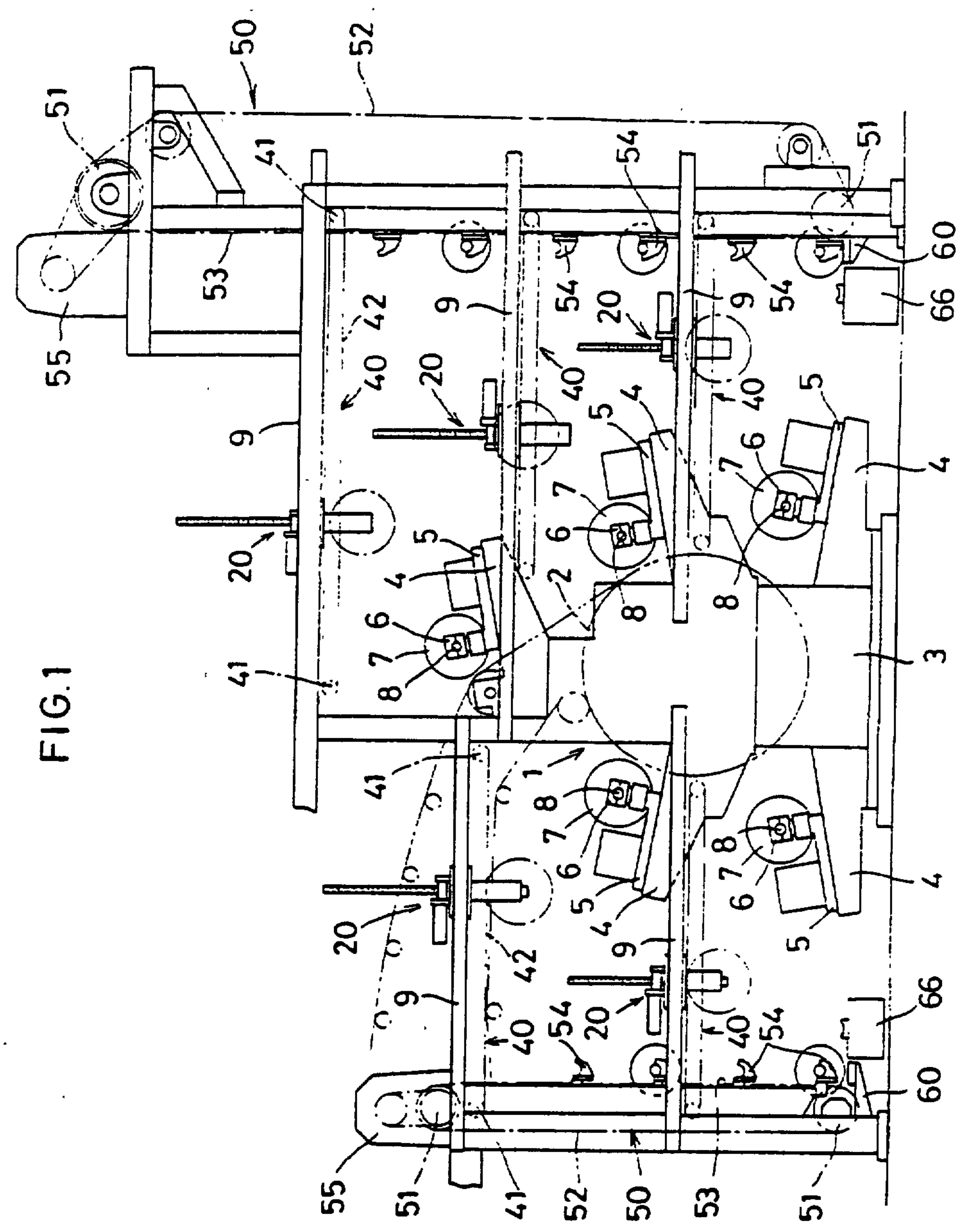


FIG.1

FIG. 2

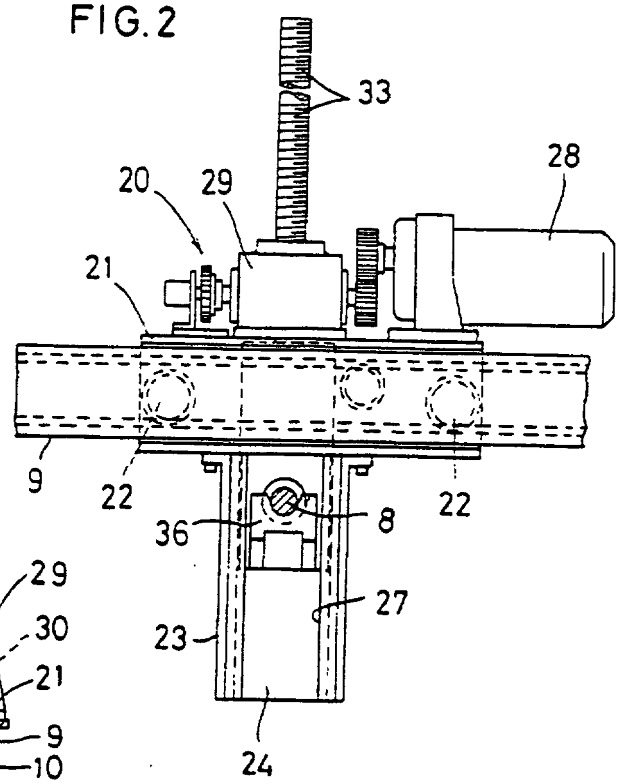


FIG. 3

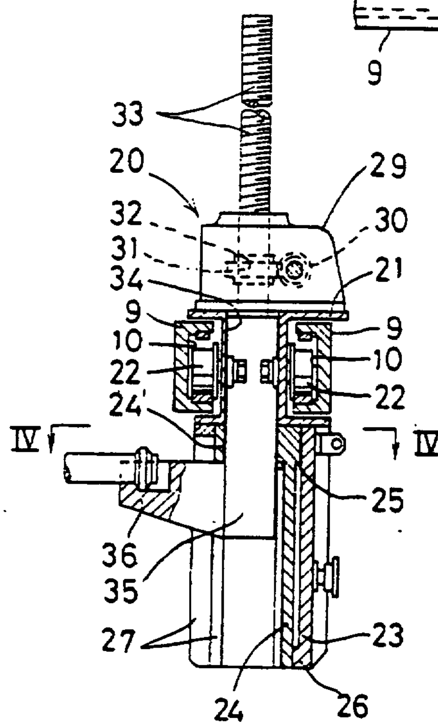
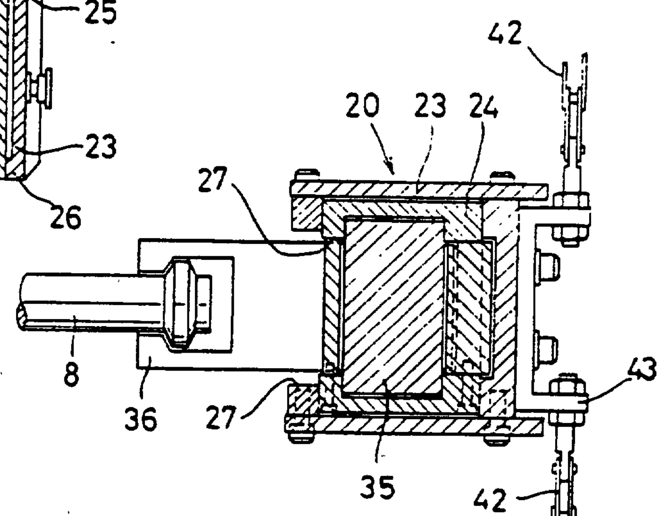


FIG. 4



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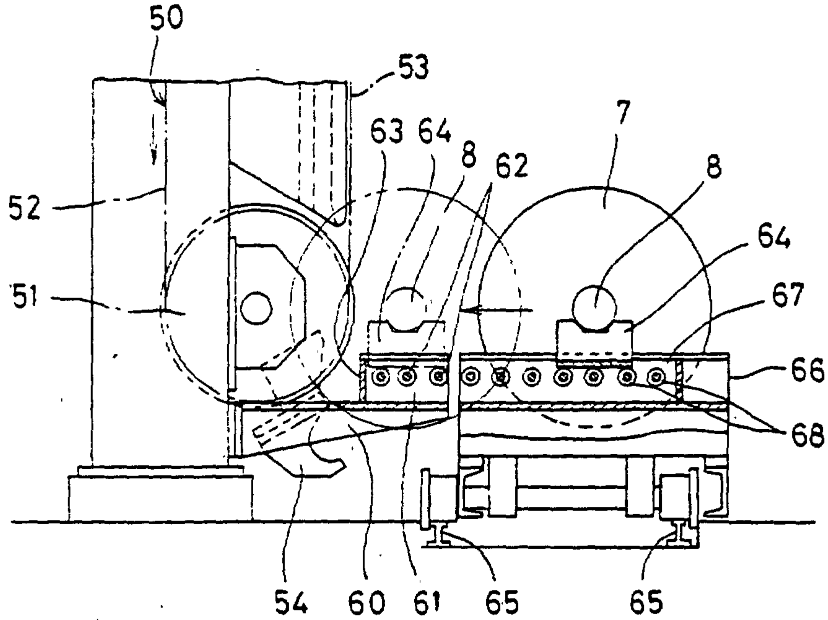
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FIG. 6

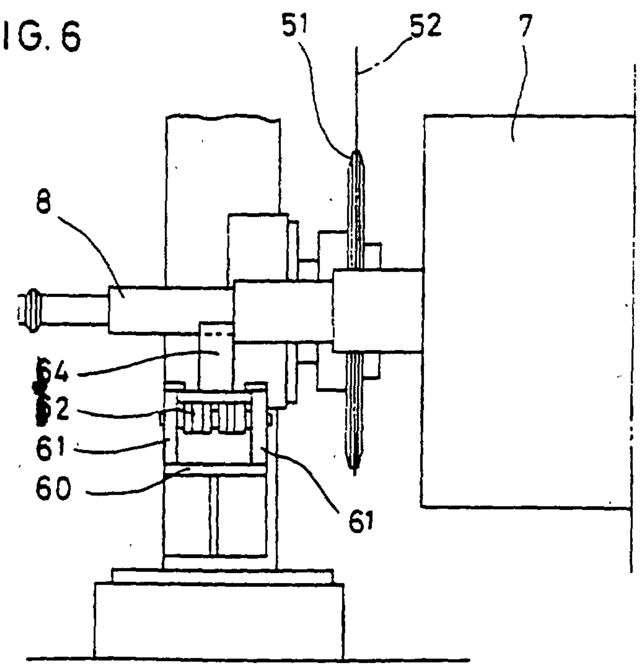
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FIG. 7

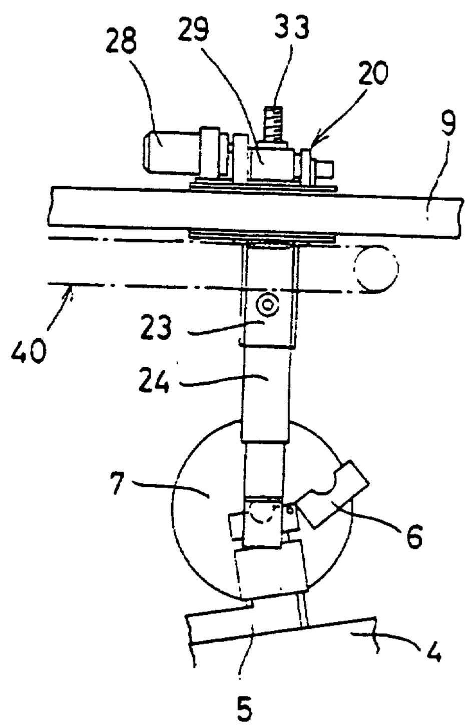
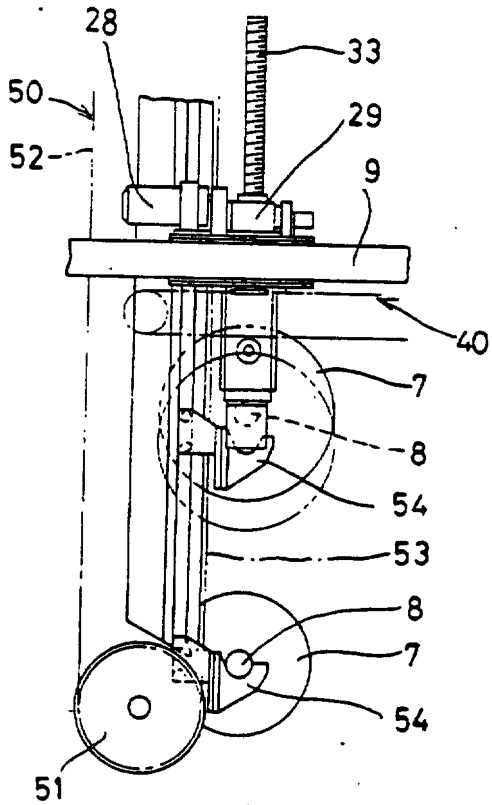


FIG. 8



DEVICE FOR REPLACING PLATE CYLINDERS

The present invention relates to a device for replacing plate cylinders for a color rotary press having a plurality of plate cylinders.

On this type of color rotary press, heavy plate cylinders weighing several hundreds kilograms have to be replaced in a narrow space each time the printing pattern changes. This replacement work has so far been performed by two men each operating one chain block adapted to support one end of the shaft of a plate cylinder and move along an overhead rail. Two operators had to operate the chain blocks in coordinated timing. If timing should be bad, the suspended plate cylinder would swing, dangle or tilt, bumping the press and causing damage to the press and/or the plate cylinder. Thus the replacement work was time-consuming, inefficient and dangerous.

An object of the present invention is to provide a device for replacing a plate cylinder which allows the replacement quickly, efficiently and safely.

One feature of the present invention is that for each plate cylinder, a pair of suspending units and a pair of travellers are provided so that the plate cylinders can be replaced not one after another but all at the same time.

Another feature of the present invention is the provision of a pair of elevator conveyers which have a plurality of bearings and serve to receive the old plate cylinders from the travellers and deliver new plate cylinders to the travellers.

A further feature of the present invention is that the suspending units and the elevator conveyors have bearings adapted to engage and support each end of the shaft of the plate cylinder and that their bearings are arranged so that the plate cylinder on the bearings of the suspending units will be received by the bearings of the elevator conveyors either by moving the bearings of the suspending units downwardly past the bearings of the elevator conveyor or moving the latter upwardly past the former and so that the plate cylinder on the bearings of the elevator conveyor will be received by the bearings of the suspending units either by moving the bearings of the elevator conveyor downwardly past the bearings of the suspending units or moving the latter upwardly past the former.

Other objects and features of the present invention will become apparent from the following description taken with reference to the accompanying drawings, in which:

FIG. 1 is a front view of the device for replacing plate cylinders embodying the present invention;

FIG. 2 is a front view of a suspending unit used in the device;

FIG. 3 is a vertical sectional side view of the suspending unit;

FIG. 4 is a sectional view taken along the line IV—IV of FIG. 3;

FIG. 5 is a vertical sectional front view of the lower portion of the elevator conveyor used in the device;

FIG. 6 is a side view thereof;

FIG. 7 is a front view showing how the used plate cylinder is picked up by the suspending unit; and

FIG. 8 is a front view showing how the plate cylinder supported by the suspending unit is received on a bearing of the elevator conveyor.

Referring to FIG. 1, a rotary press 1 for color printing has an impression cylinder 2, a pair of side frames 3 for supporting the impression cylinder, a plurality (five in the embodiment) of beds 4, and plate cylinder carriers 5 each slidably mounted on the beds 4 and provided with a bearing 6 for turnably supporting one end of a shaft 8 of a plate cylinder 7.

Each plate cylinder carrier 5 is supported so as to be slidable toward the impression cylinder 2. The bearing 6 on each plate cylinder carrier 5 is a two-part unit (FIG. 7). With the bearing separated, the plate cylinder 7 can be pulled up off the bearing.

Over each plate cylinder 7, there are a pair of rails 9 arranged in parallel with each other and extending in a direction perpendicular to the axis of the plate cylinder. These rails serve as a guide member. As shown in FIG. 3, one opposed pair of rail segments 9 form one set, each having a guide groove 10 in its inner side. A cylinder suspending unit 20 is supported so as to be slidable along a pair of the guide grooves 10.

As shown in FIGS. 2–4, the suspending unit 20 comprises a motor base 21 having rollers 22 secured to each side thereof so as to roll in the rails 9. The top of an outer guide tube 23 is secured to the lower end of the motor base 21. An inner tube 24 is fitted in the outer guide tube 23 and adapted to fall under its own weight until its stepped portion 25 abuts on a shoulder 26 formed on the inner wall of the outer tube 23. The outer guide tube 23 and the inner tube 24 are formed with a guide slot 27 (FIG. 4) extending in a vertical direction.

A motor 28 and a gear case 29 are supported on the motor base 21 (FIG. 2). The gear case 29 accommodates a worm gear 30 driven by the motor 28 and a worm wheel 31 engaging the worm gear. (FIG. 3) The worm wheel 31 is adapted to turn at a fixed position and has a threaded hole 32 in its center. A threaded shaft 33 threadedly engaging the threaded hole 32 extends upwardly through the gear case 29.

A bearing support 35 is secured to the lower end of the threaded shaft 33 and is disposed in a hole 34 formed in the center of the motor base 21. (FIG. 3) The bearing support 35 has its lower end fitting in the inner tube 24. A top-open bearing 36 secured to the lower end of the bearing support 35 protrudes outwardly from the guide slots 27 formed in the outer guide tube 23 and the inner tube 24. (FIG. 4) Also, the bearing 36 engages a top plate 24' of the inner tube 24 to prevent the latter from falling under its own weight. (FIG. 3)

One pair of the abovesaid suspending units 20 are provided for each plate cylinder. The motors 28 for the pair of the suspending units are controlled to be turned on and off at the same time so that the plate cylinder suspended by them will never be tilted.

The suspending unit 20 of the abovesaid structure is adapted to move along the rail 9 when a traveller 40 is driven. (FIG. 1) The traveller 40 comprises a pair of sprockets 41 (FIG. 1) arranged under each rail 9 at each end thereof, and a chain 42 passing around the sprockets 41 having its ends secured to a chain clamp 43 secured to an upper portion of the outer guide tube 23. (FIG. 4)

One pair of the abovesaid travellers 40 are provided for each plate cylinder. One of their two sprockets is driven by a common motor (not shown) through a common driving shaft (not shown) so that the pair of the travellers for each plate cylinder will be driven in synchronization.

The traveller 40 in the preferred embodiment is a mere example. The traveller may comprise a rack as a guide member, a pinion turnably mounted on the suspending unit 20 to engage the rack, and a motor

mounted on the suspending unit for driving the pinion, so that the suspending unit will travel along the rack. In such an arrangement, too, the motors are controlled so that the pair of travellers will be driven in synchronization.

At the outer ends of the rails 9, namely, at each side of the rotary press 1. a pair of elevator conveyors 50 for raising and lowering the plate cylinders 7 are arranged. Each of the elevator conveyors 50 comprises sprockets 51 arranged one above the other, an endless chain 52 passing around the sprockets 51, and a plurality of top-open bearings 54 secured to the endless chain 52. The inner path of the endless chain 52 crosses the rails 9 of the travellers 40. One of the pair of the elevator conveyors 50 have the bearings 54 secured at the same level or height as the bearings of the other elevator conveyor. One of the sprockets 51 of the pair of elevator conveyors 50 are driven by a common motor 55 through a common driving shaft (not shown) for synchronous drive.

The number of the bearings 54 may be decided depending on the number of the plate cylinders arranged at each side of the impression cylinder 2. In the embodiment of FIG. 1, there are two plate cylinders 7 to the left of the impression cylinder 2 and three plate cylinders to its right. In this embodiment, the lefthand pair of the elevator conveyors 50 each should preferably have four or more bearings 54 and the righthand pair of them each should have six or more bearings 54.

As shown in FIGS. 5 and 6, at bottom of each elevator conveyor 50, there is a roller support arm 60 from which a pair of roller support plates 61 extend upwardly to turnably support a plurality of rollers 62 therebetween. A positioning plate 63 is provided at one end of the roller support plates 61. A block 64 for supporting the plate cylinder is passed onto the rollers 62 from the other end. With the block 64 butting the positioning plate 63, the axis of the plate cylinder 7 supported on the block 64 is perpendicular to the track on which the bearing 54 moves.

In front of each roller support arm 60, a pair of rails 65 are provided to extend in a direction perpendicular to the roller support arm 60. A handcar 66 is supported so as to be movable along the rails 65. On the handcar 66, a pair of roller support plates 67 are provided to turnably support a plurality of guide rollers 68 therebetween.

In use, the shaft 8 of the plate cylinder 7 to be used next is supported on a pair of the blocks 64 which are on the rollers 68 in the handcar 66. The handcar is pushed to move on the rails 65 until the roller support plates 67 on the handcar 66 are aligned with the roller support plates 61 on each roller support arm 60. The blocks 64 are then moved from on the rollers 68 on the handcar 66 to on the rollers 62 on the roller support arms 60 until the blocks abut the positioning plates 63. The chains 52 of the elevator conveyors 50 are moved in the direction of arrow on FIG. 5 until the bearings 54 secured to the chains 52 engage the shaft 8 of the new plate cylinder 7 from under. The plate cylinder 7 is then conveyed upwardly by the elevator conveyors 50.

By repeating the abovesaid step, a plurality of new plate cylinders 7 can be supported on the bearings 54 of the elevator conveyors 50. The pair of the bearings 54 just above the one supporting the plate cylinder should be kept vacant, as shown in FIG. 1. This work for preparing the next plate cylinders may be performed while the rotary press 1 is in operation.

In order to replace the old plate cylinder 7 with a new one, firstly get it away from the impression cylinder 2 and then drive a pair of the travellers 40 in synchronization to move a pair of suspending units 20 along the rails 9 toward the plate cylinder 7 that has been used. until they come obliquely over the plate cylinder. The motors 28 (FIG. 2) of the pair of the suspending units 20 are then started at the same time.

As each worm wheel 31 is driven through the worm gear 30, the threaded shaft 33 will go down. When a pair of the bearings 36 secured to the bottom of the threaded shafts 33 through the bearing supports 35 come below the shaft 8 of the plate cylinder 7, the motors 28 are stopped. The travellers 40 are then driven to move the suspending units 20 to such a position where the bearings 36 are just under the shaft 8. The motors 28 are actuated to raise the threaded shafts 33 to bring the bearings 36 into engagement with the shaft 8 of the plate cylinder 7 at each end thereof, suspending the used plate cylinder 7 (FIG. 7). The bearings 6 on the plate cylinder carriers 5 are separated beforehand into two units for their upper half not to prevent the plate cylinder from being suspended.

The used plate cylinder 7 supported on the bearings 36 is moved to above the vacant bearings 54 on the elevator conveyors 50, by actuating the motors 28 and the travellers 40 suitably. Either the bearings 36 are then lowered, or the vacant bearings 54 on the elevator conveyors 50 are raised until the shaft 8 of the plate cylinder 7 is supported on the bearings 54 (FIG. 8). The suspending units 20 are moved away from the elevator conveyors 50 not to obstruct their operation.

The vertical portions 53 of chains 52 of the elevator conveyors 50 are moved upwardly to move the plate cylinder 7 to be used next to a desired height. The new plate cylinder is received on the bearings 36 of the suspending units 20 either by raising the vacant bearings 36 toward the new plate cylinder on the bearings 54 or by lowering the latter toward the former. The suspending units 20 are then moved by the travellers 40 along the rails 9 until the plate cylinder 7 comes right over the bearings 6 of the plate cylinder carriers 5. The motors 28 are actuated to lower the bearings 36 until the shaft 8 of the new plate cylinder 7 gets on the bearings 6 on the plate cylinder carriers 5. This completes the replacement of the plate cylinder 7.

On the other hand, the used plate cylinder 7 supported on the bearings 54 of the elevator conveyors 50 is lowered onto the blocks 64 which are on the rollers 62 on the roller support arms 60. It is then moved on to the rollers 68 on the handcar 66 and is moved to its storing station by moving the handcar along the rails 65.

Such a locus of the movement of the bearings 36 may be determined beforehand and memorized in a controller that the plate cylinder 7 supported on the suspending units 20 will be conveyed within the shortest possible period of time without colliding or bumping any other part of the press. The suspending units 20 for moving the plate cylinder vertically and the travellers 40 for moving it horizotally may be controlled by use of the signals from the controller memorizing such a locus. Further, the elevator conveyors 50 may be controlled to coordinate the movement of their bearings 54 with the movement of the bearings 36 so that the replacement work will be controlled fully automatically.

The arrangement of the present invention is such that all of the plate cylinders on one rotary press can be replaced automatically and simultaneously.

What we claim:

1. A device for replacing plate cylinders for a color printer having a plurality of plate cylinders, said device comprising:

a plurality of pairs of suspending means having a bearing adapted to support one end of the shaft of the plate cylinder and to be movable in a vertical direction for suspending the plate cylinder;

a plurality of pairs of travelling means for moving the plate cylinder supported on said suspending means in a horizontal direction; and

at least one pair of elevator conveyors having a conveyor body movable up and down and a plurality of bearings secured to said conveyor body for supporting each end of the shaft of the plate cylinder;

the bearings of said suspending means and the bearings of said elevator conveyors being arranged so that the plate cylinder on the bearings of said suspending means will be received by the bearings of said elevator conveyors either by moving the bearings of said suspending means downwardly past the bearings of said elevator conveyor or moving the latter upwardly past the former and so that the plate cylinder on the bearings of said elevator conveyor will be received by the bearings of said suspending means either by moving the bearings of said elevator conveyor downwardly past the bearings of said suspending means or moving the latter upwardly past the former.

2. The device as claimed in claim 1, wherein said suspending means comprises a threaded shaft extending vertically, a worm wheel engaging said threaded shaft, a worm gear engaging said worm wheel, and drive means for driving said worm gear to raise and lower said threaded shaft, said bearing being secured to the bottom of said threaded shaft.

3. The device as claimed in claim 1, wherein said travelling means comprises a guide rail extending over the plate cylinder in a direction perpendicular to the axis of the plate clyinder, a pair of sprockets arranged under said guide rail, a chain passing around said sprockets, and drive means.

4. The device as claimed in claim 1, wherein the bearings of said suspending means and the bearings of said elevator conveyors are of a top-open type.

* * * * *

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United States Patent [19]
Jahn

[11] Patent Number: 4,615,293
[45] Date of Patent: Oct. 7, 1986

[54] MEDIUM-APPLYING DEVICE IN A PRINTING MACHINE

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[73] Assignee: Heidelberger Druckmaschinen AG, Heidelberg, Fed. Rep. of Germany

[21] Appl. No.: 636,916

[22] Filed: Aug. 2, 1984

[30] Foreign Application Priority Data

Aug. 3, 1983 [DE] Fed. Rep. of Germany 3327993

[51] Int. Cl.⁴ B05C 1/02; B05C 11/10
[52] U.S. Cl. 118/46; 118/212; 118/221; 118/249; 118/255; 118/262
[58] Field of Search 118/46, 221, 222, 255, 118/262, 212, 249

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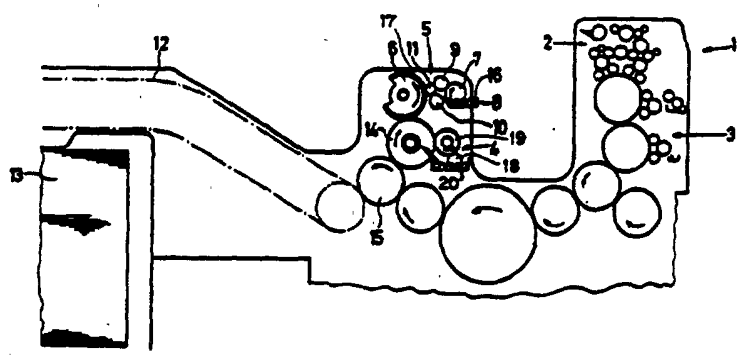
Primary Examiner—Evan K. Lawrence

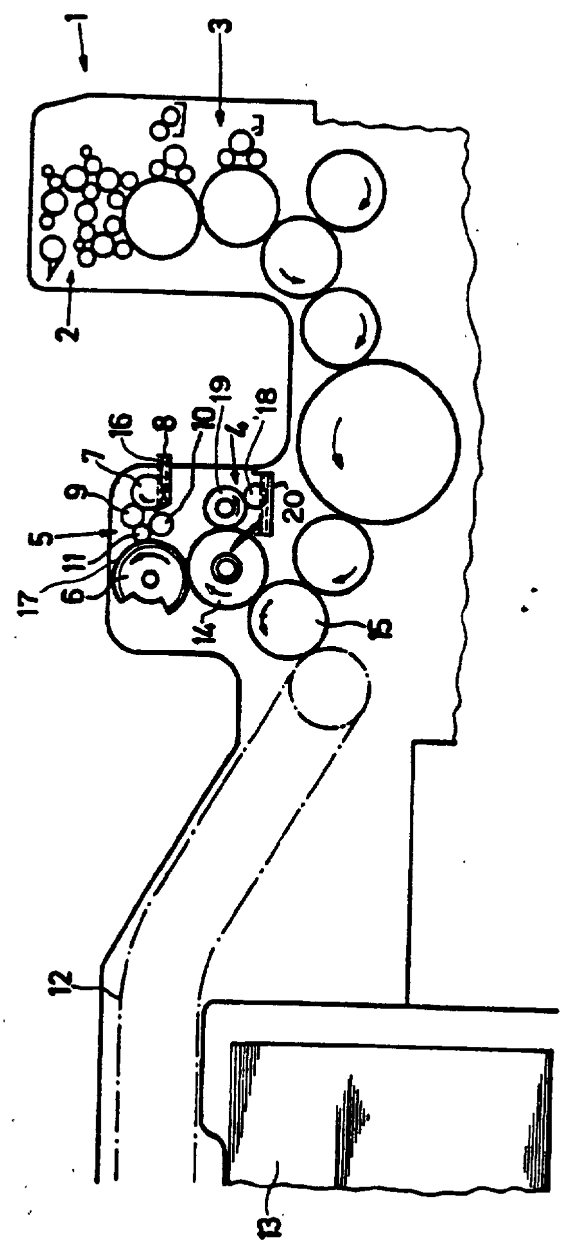
Attorney, Agent, or Firm—Herbert L. Lerner; Laurence A. Greenberg

[57] ABSTRACT

In a printing machine, a medium applicator disposed downstream of printing units of the machine, in travel direction through the machine of a sheet being printed, the medium applicator having an assembly formed of a first roller for taking up medium from a supply container, a second roller for metering a quantity of the medium to be applied, and a third roller for transferring the medium, the third roller having a continuous cylindrical surface with a rubber lining disposed thereon for directly applying the medium onto the sheet, the three rollers being in constant meshing engagement with a sheet-transfer cylinder during application of the medium, the medium applicator further comprising a plate cylinder having a cylindrical surface interrupted by a transverse channel and carrying a flexible relief plate having raised surfaces thereon, and another assembly of rollers for supplying medium from another supply container to the raised surfaces of the flexible relief plate, the plate cylinder being in operative engagement with the third roller.

3 Claims, 1 Drawing Figure

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MEDIUM-APPLYING DEVICE IN A PRINTING MACHINE

The invention relates to a medium applicator in a printing machine and, more particularly, to such a medium applicator which is disposed downstream of printing units of a printing machine, as viewed in travel direction through the machine of a sheet being printed therein, the medium applicator having an assembly formed of a first roller for taking up medium from a supply container, a second roller for metering a quantity of the medium to be applied, and a third roller for transferring the medium, the third roller having a continuous cylindrical surface with a rubber lining disposed thereon for directly applying the medium onto the sheet, the three rollers being in constant meshing engagement with a sheet-transfer cylinder during application of the medium. A medium applicator of this general type has been described in my commonly owned co-pending application Ser. No. 626,732 filed July 2, 1984, now abandoned.

A lacquering or varnishing device in printing machines has become known heretofore from German Published Non-Prosecuted Application No. (DE-OS) 30 46 257. This device includes a lacquer storage tank or supply container and a scooping roller dipping into this tank. The lacquer taken up by the scooping roller is fed in metered fashion to an applicator roller. Two doctor rollers, by means of which a format-related lacquer feed occurs, can be set close to the scooping roller. A ductor blade applicable against the metering roller is also provided. This ductor blade serves to wipe superfluous lacquer from the metering roller and to return it to the supply container.

A specific disadvantage of this heretofore known device is that the lacquer is fed to the varnishing or lacquering cylinder via a distributor roller and an application roller. Because of the relatively long transport distance which the lacquer has to cover over many rollers until it reaches the printed sheet, the lacquer begins to set i.e. no quick-drying lacquers can be used. Due to this limitation to slowly drying lacquers, when the sheet is delivered the reverse side or back of the next following sheet will smear the lacquer and thus paste the sheets together. Consequently, no full sheet piles can be set up, because the pile weight which is built up at the delivery end and which applies a load to the individual sheets also limits the lacquer layer thickness.

In the device described in German Pat. No. 23 45 183 for applying a medium there are provided a dipping roller, a metering roller, an applicator roller, a back-pressure cylinder, a form cylinder and another applicator roller. The two applicator rollers, the dipping roller and the metering roller are combined into a common structural unit. Within this structural unit, either the dipping roller with the form cylinder or the first applicator roller with the form cylinder or the second applicator roller with the back-pressure cylinder can cooperate.

A disadvantage of this last-mentioned construction is that the lacquer must first be fed to the printed material via the form cylinder. The platen mounted on the clamping device at the form cylinder forms a channel in which the lacquer accumulates after a given operating time. This lacquer-accumulation results in an irregular lacquer application due to dripping of the lacquer down onto the printed material.

German Pat. No. 20 20 584 is based upon a device for avoiding smearing of the ink due to lacquering. By means of a lacquering unit, the lacquer is applied to a printing-unit cylinder. This printing-unit cylinder, which has the same diameter as that of the cylinders of the preceding printing units, transfers the lacquer to the printed material. The disadvantages referred to hereinbefore are also applicable to this construction and require additionally, time-consuming cleaning work to be performed on the rollers. Moreover, the construction of the printing unit is complicated by having to attach the lacquering unit to the rubber of blanket cylinder.

A further disadvantage of the state of art as exemplified by the references cited hereinbefore, is that, due to the directions of rotation of the rollers, the format-related wiping by the ductor blade cannot be observed, thus making impossible a precise wiping or removal of the superfluous lacquer material.

It is an object of the invention of the instant application to provided a further improvement over the construction in my aforementioned co-pending application in the form of a supplemental medium-applying device which is suitable especially for coating or lacquering surfaces which are interrupted or spaced from one another and, furthermore, to provide a supplementary medium applicator or lacquering unit for applying coatings or for lacquering with layers of any selected thickness.

With the foregoing and other objects in view, there is provided, in accordance with the invention, in a printing machine, a medium-applicator disposed downstream of printing units of the machine, in the travel direction through the machine of a sheet being printed, the medium applicator having an assembly formed of a first roller for taking up medium from a supply container, a second roller for metering a quantity of the medium to be applied, and a third roller for transferring the medium, the third roller having a continuous cylindrical surface with a rubber lining disposed thereon for directly applying the medium onto the sheet, the three rollers being in constant meshing engagement with a sheet-transfer cylinder during application of the medium, the medium applicator further comprising a plate cylinder having a cylindrical surface interrupted by a transverse channel and carrying a flexible relief plate having raised surfaces thereon, and another assembly of rollers for supplying medium from another supply container to the raised surfaces of the flexible relief plate, the plate cylinder being in operative engagement with the third roller.

In this lacquering device or medium application, it is possible to apply medium or lacquer by means of a flexible relief or letterpress plate which is disposed on a plate cylinder. Fields or sections of the most varied size and shape are provided on this relief plate in order to perform the desired application of medium or lacquering of areas which are interrupted or spaced from one another.

In accordance with a further feature of the invention, the first, second and third rollers and the medium supply container associated therewith form a first-medium applying device, and the plate cylinder, the other assembly of rollers and the other supply container form a supplementary medium-applying device, and means are included for operating the first medium-applying device simultaneously with the supplementary medium-applying device.

In accordance with an added feature of the invention, the medium is a lacquer.

Both medium-applying or lacquering devices are used simultaneously in order to attain a maximum coating thickness of the medium or lacquer at least at predetermined areas of the sheet.

Other features which are considered as characteristic for the invention are set forth in the appended claims.

Although the invention is illustrated and described herein as embodied in medium-applying device in a printing machine, it is nevertheless not intended to be limited to the details shown, since various modifications and structural changes may be made therein without departing from the spirit of the invention and within the scope and range of equivalents of the claims.

The construction and method of operation of the invention, however, together with additional objects and advantages thereof will be best understood from the following description of specific embodiments when read in connection with the accompanying single FIGURE of the drawing which is a diagrammatic elevational view of the printing machine having a first lacquering device and a doctor blade assembly arranged at an applicator roller and disposed in front of a delivery unit and, in accordance with the invention, having a supplementary lacquering device located above the first lacquering device.

Referring now to the FIGURE of the drawing, there is shown therein a last printing unit 1 of a printing machine having a conventional inking unit 2 and a conventional dampening unit 3. Following the last printing unit 1, in direction of feed of paper through the printing machine from the right-hand side to the left-hand side of the drawing FIGURE, is a duplex lacquering unit formed of a first lacquering device 4 and a supplementary lacquering device 5 disposed above the first lacquering device 4. Printed sheets are conveyed from the last printing unit 1 to the lacquering devices 4 and 5, respectively. After the consequent treatment or processing of the sheets by the lacquering devices 4 and 5, respectively, the sheets are conveyed further by a delivery chain 12 to a delivery pile 13.

The first lacquering device 4 includes a first roller 18 for taking up medium from a supply container 20, a second roller 19 for metering a quantity of the medium to be applied, and a third roller 14 for transferring the medium, the third roller having a continuous cylindrical surface with a rubber lining disposed thereon for directly applying the medium onto the sheet which is to be processed.

The supplementary lacquering device 5 disposed above the first lacquering device 4 is made up of a lacquer supply vessel or tank 8 wherein a dipping roller 7 rotates, and transfers lacquer successively to a metering roller 9, a distributor roller 10 and an applicator roller 11. The applicator roller 11 is in direct contact with a plate cylinder 6 which is provided with a flexible relief or letterpress plate 17 used for lacquering. The plate cylinder 6 transfers the lacquer applied thereto to the roller 14 which, in turn, is in contact with the sheet-transfer cylinder 15. The sheet-transfer cylinder 15 has non-illustrated grippers which are sunk below the outer cylindrical surface thereof i.e. the back of the gripper is disposed lower than the surface of the sheet which is to be processed. After the consequent processing has been performed, the cylinder 15 surrenders the sheet to the delivery chain or conveyor 12 which then conveys it to the delivery pile 13.

Lacquer 16 is received in the supply tank 8 and serves for suitably treating or processing the sheet after it has been printed. During the rotation of the dipping roller 7, it picks up the lacquer 16 from the supply tank 8 and transfers the lacquer 16 to the metering roller 9. The applicator roller 11 disposed in contact with the metering roller 9 transfers the lacquer 16 to the relief or letterpress plate on the plate cylinder 6 which is formed with suitable recesses. The distributor roller 10 distributes the lacquer uniformly in lacquering regions provided on the applicator roller 11. The format-dependent lacquering operation is effected by means of non-illustrated conventional doctor-blade devices which are attachable to the metering roller 9.

The relief or letterpress plate disposed on the plate cylinder 6 is suitably furnished with surfaces required for the lacquering process. The lacquer 16 adheres to the raised surfaces of the relief plate and at these locations, is transferred to the roller 14. Further transfer of the lacquer is effected via the roller 14 directly to the sheet being printed which is located on the sheet-transfer cylinder 15.

With the foregoing embodiment of the invention, it is possible to provide non-illustrated means either to use the first lacquering unit 4 individually or, if specific breaks or discontinuities i.e. spacings, in the lacquer coating applied to the material being printed are required, to use the supplementary device 5 individually or, if special coating thicknesses of the lacqeer is required, to use the duplex lacquering unit, namely both the first lacquering device 4 and the supplementary lacquering device 5 simultaneously.

There are claimed:

1. In a printing machine, a medium applicator disposed downstream of printing units of the machine, in the travel direction through the machine of a sheet being printed, the medium applicator having an assembly formed of a first roller for taking up medium from a supply container, a second roller for metering a quantity of the medium to be applied, and a third roller for transferring the medium, the third roller having a continuous cylindrical surface with a rubber lining disposed thereon for directly applying the medium onto the sheet, the three rollers being in constant meshing engagement with a sheet-transfer cylinder during application of the medium, the medium applicator further comprising a plate cylinder having a cylindrical surface and carrying a flexible relief plate having raised surfaces thereon, and another assembly of rollers for supplying medium from another supply container to said raised surfaces of said flexible relief plate, said plate cylinder being in operative engagement with the third roller.

2. Medium applicator according to claim 1 wherein the first, second and third rollers and the medium supply container associated therewith form a first-medium applying device, and said plate cylinder, said another assembly of rollers and said another supply container form a supplementary medium applying device, and further including means for operating said first medium applying device simultaneously with said supplementary medium applying device.

3. medium applicator according to claim 1 wherein the medium is a lacquer.

* * * * *

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United States Patent [19]

Switall

[11] **Patent Number: 4,617,865**

[45] **Date of Patent: Oct. 21, 1986**

[54] **LIQUID COATER FOR A PRINTING PRESS WITH MOVEABLE INKING ROLLER AND TRAY**

[75] Inventor: **Thomas G. Switall, Wheeling, Ill.**

[73] Assignee: **Ryco Graphic Manufacturing, Inc.,** Wheeling, Ill.

[21] Appl. No.: **763,274**

[22] Filed: **Aug. 7, 1985**

[51] **Int. Cl.**[4] **B41F 31/00**

[52] **U.S. Cl.** **101/350;** 101/367

[58] **Field of Search** .... 101/348–352, 101/375, 364, 247, 367, 207–210, DIG. 10, 148, 137, 139–140, 143–145, 182–185

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Primary Examiner—E. H. Eickholt
Attorney, Agent, or Firm—Lee, Smith & Zickert

[57] **ABSTRACT**

The coating apparatus disclosed in this application is for a printing press having a recessed printing cylinder. The mechanism comprises a frame, a tray mounted on the frame for holding a supply of the coating material and roller means carried by the frame for transferring the liquid coating material from the tray to the printing cylinder. A pair of track members extend upwardly and rearwardly from the press and the frame is mounted on these tracks for movement toward and away from the printing press cylinder. Means is provided for moving the frame between its remote position and its position adjacent the printing press cylinder. The roller means and the tray are preferably mounted on a subframe which is pivotally mounted on the frame and means is provided for pivoting the subframe so that the roller means will move into position for engagement with the printing press cylinder after the frame has been moved into its position adjacent the cylinder. Means is also provided for positively locking the frame in its position adjacent the cylinder.

17 Claims, 9 Drawing Figures

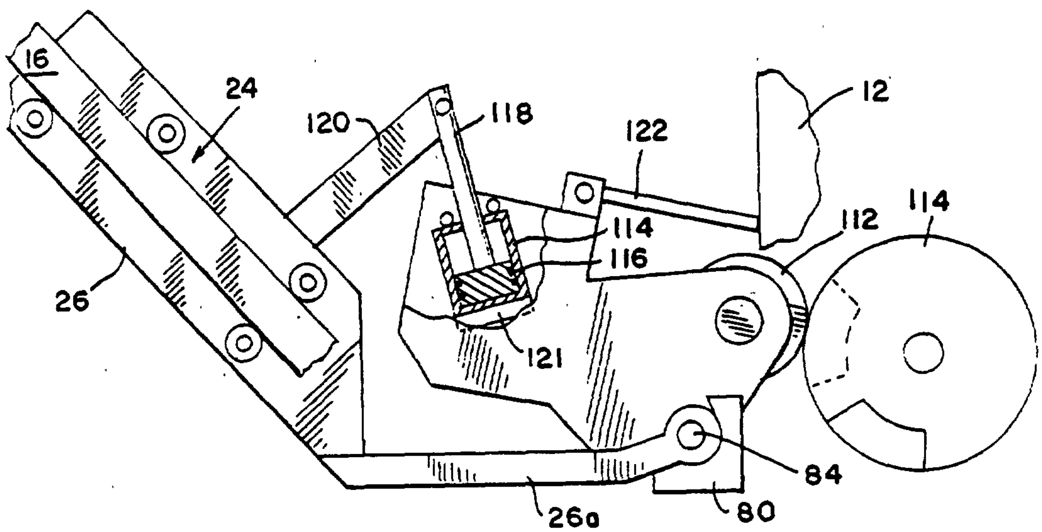

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FIG-4

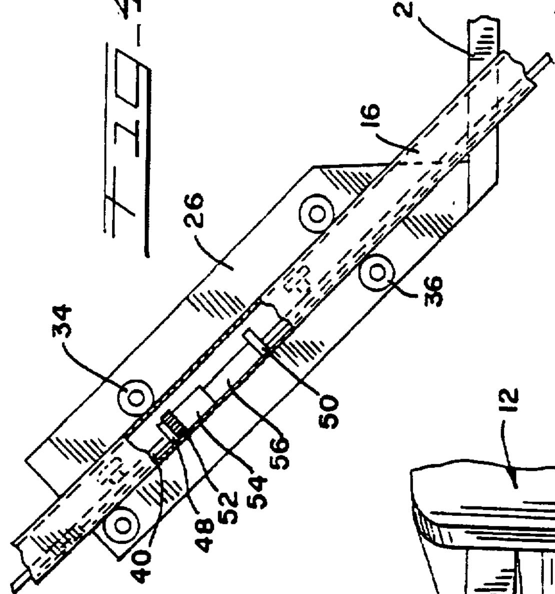

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FIG-1

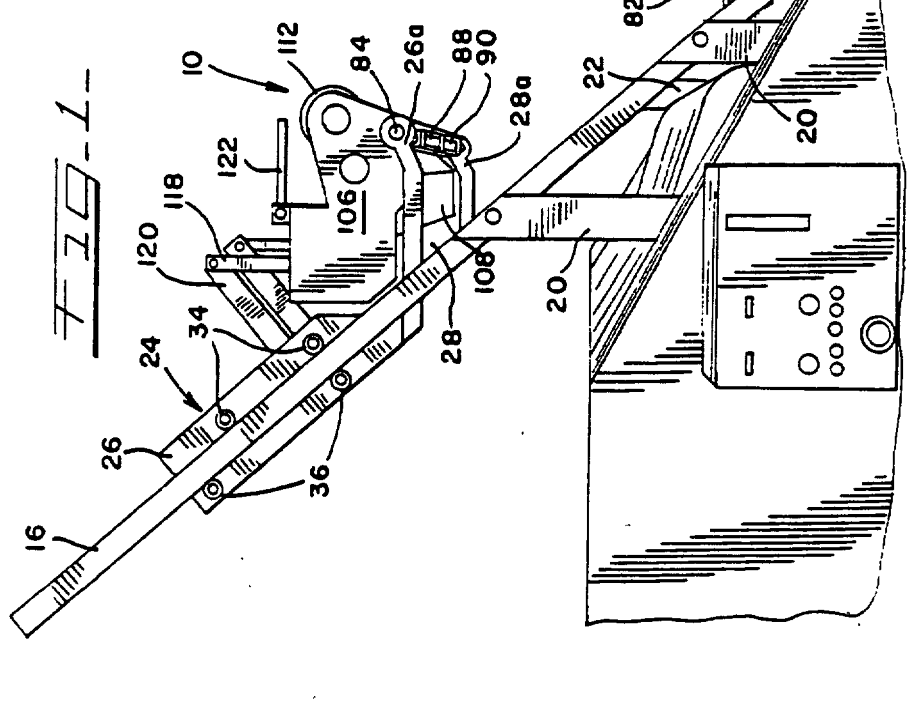

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FIG-2-

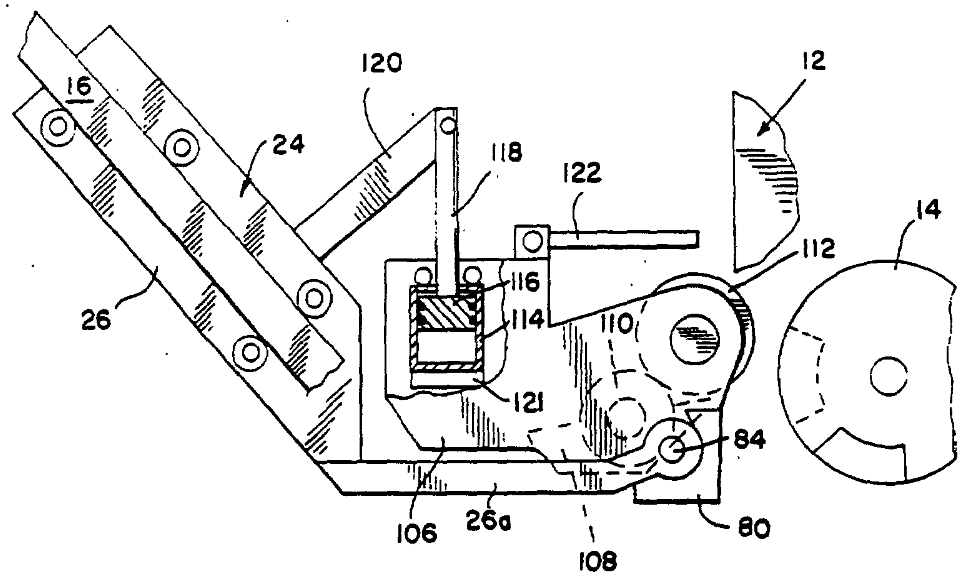
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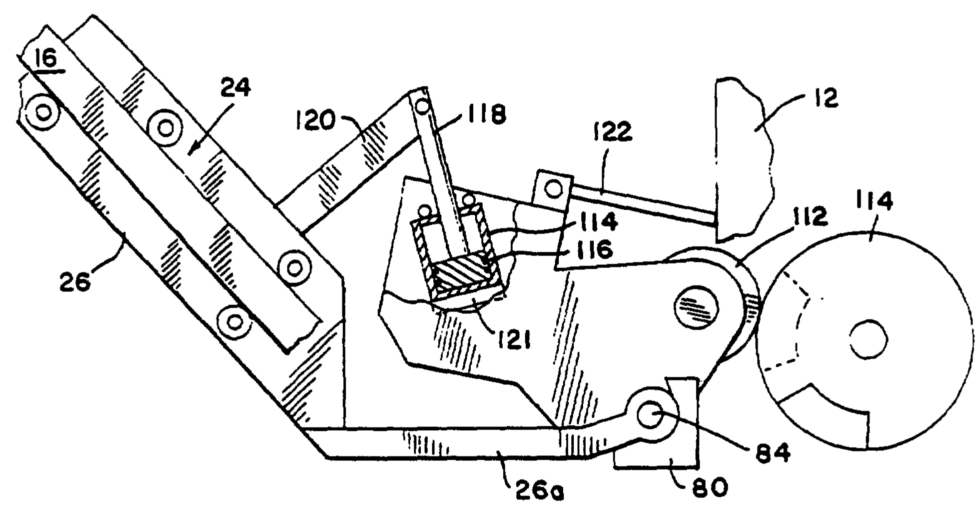
FIG-3-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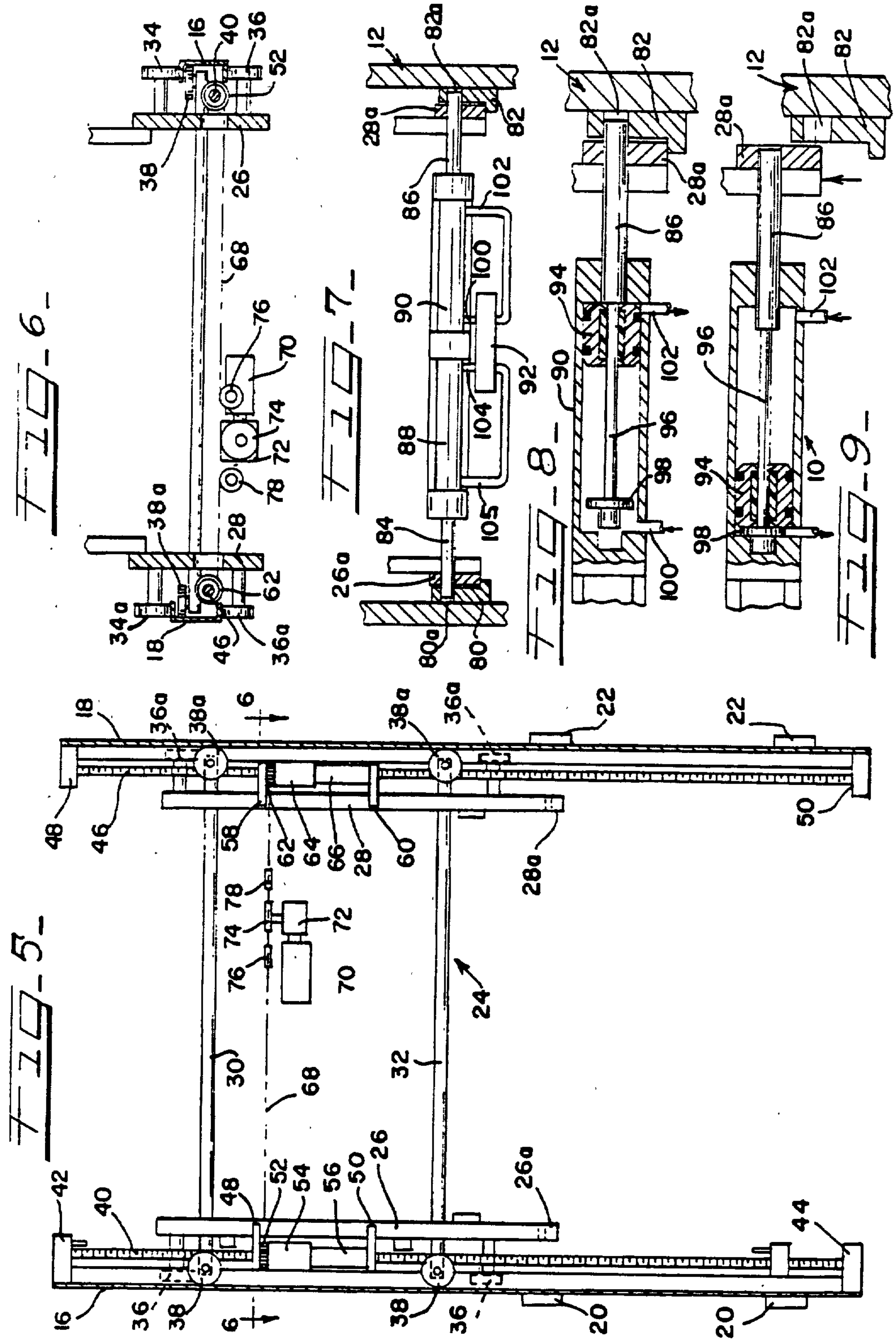

FIG. 5
FIG. 6
FIG. 7
FIG. 8
FIG. 9

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LIQUID COATER FOR A PRINTING PRESS WITH MOVEABLE INKING ROLLER AND TRAY

BACKGROUND AND SUMMARY OF THE INVENTION

This invention relates to a liquid coater for supplying a liquid coating material to a printing press cylinder for transfer to the paper web or sheet being printed. The mechanism has particular application to a printing press having a recessed cylinder. The mechanism permits the coating rollers and tray holding the coating material to be selectively moved into and out of position for coating. When the coating rollers and tray are moved out of position they will not interfere with the printing operation or otherwise be in the way of the press operator.

It has become common practice to utilize a coater for applying a liquid coating material to the blanket of a web offset printing press so that the printed sheet or web which is moving through the press can be coated. The coating material is usually an aqueous coating which when dry renders the printed paper resistent to moisture and oils and prevents smearing. The coaters for applying this material generally utilize a tray for holding the liquid coating material and a feed roller rotating in the liquid coating material in the tray. A coater roller is in rotating engagement with the feed roller and also in rotating engagement with the blanket cylinder of the printing press. The coating material is picked up from the tray by the feed roller, transferred to the coater roller, and retransferred to the blanket by the coater roller.

Since the coater is an adjunct to the printing press, the main function of the press being to print, the coater must be capable of being moved into and out of position with respect to the blanket cylinder. The coater may be rotrofitted onto existing presses, or it may be worked into existing press designs. In most presses, the coater can be easily added and is not in the way of the printing operation of the press. However, in a number of printing presses, the blanket cylinder is recessed so that there is very little room for the coater to be moved into position for coating the blanket cylinder. Heretofore, it has not been possible to utilize a coater with such presses because the coater would be in the way of the press operator and interfere with the normal printing operation of the press. Thus, with presses such as the "Heidelberg Speed Master", a separate coater was heretofore required.

The present invention obviates the need for a separate coater and permits the coater to be mounted on presses which have a recessed blanket cylinder. In accordance with this invention, the coater may be moved into and out of position so that it does not interfere with the printing operation of the press and it permits the printed material to be coated as it is being moved through the printing press, thus, not only saving equipment, but saving time and labor by eliminating a separate operation on a separate piece of equipment.

In accordance with one aspect of the invention, the coater mechanism for applying a liquid coating material to the recessed printing press cylinder comprises a frame, a tray mounted on the frame for holding a supply of the coating material and roller means carried by the frame for transferring the coating material from the tray to the printing press cylinder. Track means is attached to the printing press and extends from adjacent the printing press cylinder to a point remote from the printing press cylinder. The tray and roller means are preferably mounted on a subframe attached and carried by the coater frame and the coater frame in turn in mounted on the track means. Means is provided for moving the frame and the subframe with the tray and roller means carried thereon, along the track means into and out of position adjacent the printing press cylinder, and means is provided for moving the roller means into and out of position for engagement with the printing press cylinder after the coater frame has been moved to its position adjacent the cylinder. It is preferred that there be a means for locking the coater frame in its position adjacent the cylinder when it has been moved into that position. Once the frame has been moved into its position adjacent the printing press cylinder, and the subframe has been moved to position the roller means into contact engagement with the printing press cylinder, the liquid coating material may be picked up from the tray by the roller means and applied to the printing press cylinder.

In the preferred embodiment, the track means comprises a pair of rectilinear tracks which extend upwardly and rearwardly and roller means on the frame rollably engage the track means so that the frame may be moved relative to the track means toward and away from the printing press cylinder.

The frame may be moved along the track means by means of a pair of internally threaded nut members mounted for rotation adjacent opposite sides of the coater frame. Extending through the nut members and mounted in fixed position relative to the track means are a pair of spaced parallel, externally threaded rods. The drive means includes means interconnecting the nut members and for rotating them in unison selectively in a direction which will move the frame toward the press cylinder and in the opposite direction away from the press cylinder.

The subframe is preferrably pivotally mounted on the front arms of the frame so that when the frame has been moved to its lower-most position adjacent the press cylinder, the subframe may be pivoted or tilted forwardly to bring the roller means into contact with the printing press cylinder so that the coating material may be applied to the printing press cylinder.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a coater constructed in accordance with this invention showing the coater moved out of its coating position, i.e. away from engagement with the blanket cylinder of the web offset printing press.

FIG. 2 is an enlarged side elevation view of portions of the press and coater schematically showing the coater after it has been moved to its coating position adjacent the printing press cylinder.

FIG. 3 is an enlarged side elevation view of the same portions of the press and coater showing the pivotal or tilting movement of the subframe to cause the coater roller to engage the surface of the printing press cylinder for the transfer of liquid coating material thereto.

FIG. 4 is a side elevation view of a portions of the coater frame and track means, with part of the track means cut away to show part of the drive means for moving the frame of the coater along the track means toward and away from the printing press cylinder.

FIG. 5 is a top plan view of portions of the frame and track means with the subframe removed, showing the

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drive means for moving the frame along the track means.

FIG. 6 is a sectional end elevational view taken substantially the lines 6—6 of FIG. 5.

FIG. 7 is a sectional view taken across the front arms of the frame and showing the means for locking the frame into its lower-most position adjacent the press cylinder.

FIG. 8 is an enlarged end elevational view of a portion of the locking mechanism showing the mechanism in its locking position.

FIG. 9 is a view similar to FIG. 8 showing the locking mechanism after it has been moved to its unlocked position and after the frame has been moved away from its position adjacent the press cylinder.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The coater 10 constructed in accordance with this invention is illustrated in FIG. 1 where it is used on a web offset press 12. The press has a blanket cylinder 14 which is normally used in the offset printing operation of the press. However, printing presses of this type have a number of different printing stages, usually one for each color, and where one of the stages or printing roller sets is not being used for printing, it has been found convenient to utilize the blanket cylinder of that otherwise unused stage of the printing press as a means for applying a coating to the web or sheet as it moving through the press. The coating material is usually an aqueous coating which provides moisture and oil resistant matte or glossy finish to the paper and protects it from smearing.

The particular press 12 illustrated in FIG. 1 has very little room within which to apply the coating material and heretofore it has been impossible to use a coater in such a press where the blanket cylinder was recessed and other portions of the printing press prevented the coater from being moved rearwardly away from its coating position so that the blanket cylinder could be used for a printing operation as well as a coating operation.

In order to move the coater 10 into and out of position for applying the coating material to the blanket cylinder 14, a track means in the form of two channel-shaped tracks 16 and 18 are connected to the frame of the press 12 by means of supports 20 and 22, respectively (see FIG. 5). The tracks 16 and 18 extend upwardly and rearwardly at an angle of approximately 45 to 50 degrees from the horizontal. Mounted between the tracks 16 and 18 is a carriage frame 24 consisting of a pair of parallel side plates 26 and 28 and a pair of transverse bars 30 and 32 which extend between the side plates thus forming a substantially rectangular frame. The side plates 26 and 28 have arms 26a and 28a which extend forwardly and outwardly at approximately a supplementary angle with the angle of the tracks 16 and 18 so that these arms will be generally horizontal in their orientation at all times and in all positions of movement of the carriage frame 24 relative to the tracks.

The carriage frame 24 is mounted on the tracks for movement between a remote position as illustrated in FIG. 1 and a position where the coater is adjacent the blanket cylinder 14 of the printing press, schematically illustrated in FIGS. 2 and 3. For this purpose, on each of the side plates 26 and 28 there are two pairs of rollers. Roller pair 34 adjacent the top of the side plate 26 roll along the top flange of the channel-shaped track 16 and roller pair 36 located adjacent the bottom of the side plate 26 roll along the bottom flange of the track 16. This is illustrated in FIG. 1. Similar pairs of rollers 34a and 36a extend outwardly from the side plate 28 to rollably engage the top and bottom flanges, respectively, of the channel-shaped track 18. This is shown in FIGS. 5 and 6. As may also be seen in those figures, rollers 38 and 38a, rotating on vertical axes, engage the inside vertical surfaces of the tracks 16 and 18, respectively. Thus, the coater carriage frame 24 is able to move up and down the angular tracks 16 and 18 on the rollers 34, 36 and 38 and 34a, 36a and 38a, respectively.

Means is also provided for forcibly moving the carriage frame along the tracks and this is through a synchronized screw-thread drive. An externally threaded rod 40 is mounted between end mounts 42 and 44 at each end of the track 16. This rod which is a ball screw is mounted in fixed position and extends parallel to the track 16. Similarly, a ball screw 46 extends between end mounts 48 and 50 at the ends of the track 18 and this ball screw is also mounted in fixed position and extends parallel to the track 18. Extending outwardly from side plate 26 of the carriage frame are a pair of support brackets 48 and 50, and journalled for rotation between these brackets is a sprocket 52, a connector 54 and a ball nut 56. The sprocket, connector and ball nut surround the ball screw 40, and the internally threaded ball nut 56 is in threaded engagement with the threads of the ball screw 40. Similarly, on the opposite side of the carraige frame, a pair of spaced brackets 58 and 60 extend outwardly from side plate 28. Journalled for rotation between these brackets is a sprocket 62, a connector 64 and a ball nut 66, all of which surround the ball screw 46. The connectors 54 and 64 connect the sprockets 52 and 62 to their respective ball nuts 56 and 66. The sprockets 52 and 62 are operatively connected together and driven in unison by means of a sprocket chain 68. The sprocket chain in turn is driven by means of a motor 70 operating through a reduction gear box 72 and a drive sprocket 74. On either side of the drive sprocket 74 are idler sprockets 76 and 78.

Thus, the carriage frame 24 may be rolled along the tracks 16 and 18 through operation of the motor 70 which may be driven in the forward or reverse directions to drive the sprocket chain 68 and the sprockets 52 and 62. These sprockets, which are connected to the ball nuts 56 and 66, respectively, will rotate these ball nuts relative to the ball screws 40 and 46, respectively, causing the ball nut 56 to move up or down on the ball screw 40 and the ball nut 66 to move or down on the ball screw 46, thereby driving the carriage frame 24 upwardly or downwardly, depending upon the direction of operation of the motor 70.

While the ball nuts 56 and 66 may be any kind of internally threaded member to mate with the externally threaded rods 40 and 46 respectively, it is preferred that these be ball nuts and rods. The ball nuts have ball bearings arranged in an internally threaded fashion and the external threads of the ball screw 40 are adapted to mate with the ball bearings thus providing a very low friction type of connection between threse two internally and externally threaded members.

The frame 24 is adapted to be moved between an elevated and rearwardly disposed position substantially as illustrated in FIG. 1 to a lowered and forwardly disposed coating position as shown schematically in FIG. 2. In this lowered position, the rounded forward end of the arm 26a will seat in a positioning block 80

mounted on one side of the press frame, and the corresponding arm **28a** of side plate **28** will seat within a correspondingly positioning block **82** mounted on the opposite side of the press frame (see FIGS. 1, 2 and 7).

Means is provided for locking the carriage frame in its lowered position adjacent the blanket cylinder of the press. This mechanism is illustrated in FIGS. 7-9. The positioning blocks **80** and **82** mounted on opposite sides of the frame of the press **12** have holes **80a** and **82a**, respectively, which serve as keepers for the locking pins **84** and **86**. As shown in FIG. 7, when the side plate arms **26a** and **28a** of the carriage frame have been moved into position in seating engagement with the positioning blocks **80** and **82** respectively, the locking pins **84** and **86** will align with the respective holes **80a** and **82a** on the positioning blocks. In FIG. 7, the locking pins are in position within the keeper holes **80a** and **82b**, thus locking the carriage frame arms **26a** and **28a** in their lowermost position.

In order to effect locking and unlocking movements of the locking pins **84** and **86**, a pair of air cylinders **88** and **90** are provided and these are controlled by means of an air valve **92**. As may be seen in FIGS. **8** and **9**, each of the air cylinders **88** and **90** has a moveable piston **94** which has a lost motion connection with the shank **96** of the locking pin, and at the end of the shank there is an enlarged head portion **98**. The shank **96** is of substantially smaller diameter than the diameters of either the head portion **98** or the locking pins **84** and **86**, and there are air ports **100** and **102** for cylinder **90** and corresponding air ports **104** and **106** for the air cylinder **88**.

When the air valve **92** permits air under pressure to enter air port **100** and to exit air port **102** of the cylinder **90**, the piston **94** within that cylinder will be driven to the right as illustrated in FIG. **8** and impact against the locking pin **86** to drive the pin to the right into the keeper hole **82a** of the positioning block **82**. When it is desired to unlock the arms of the carriage frame, the air valve **92** is reversed, causing air to enter air port **102** and exit air port **100**. This will drive the piston **94** to the left as illustrated in FIGS. **8** and **9** to the position illustrated in FIG. **9** where it impacts the large head **98** and drives that head together with the shank **96** and the locking pin **86** to the left, thereby withdrawing the pin **86** from the keeper hole **82a**.

The operation of the air cylinder **88** is identical and simultaneous when the air valve **92** permits air to enter air port **100** it also permits air to enter air port **104** of cylinder **88** so that both pistons of the air cylinders are driven outwardly to drive the pins **84** and **86** into their respective keepers **80a** and **82a** to lock the arms of the carriage frame in position. When the air valve **92** is reversed and air is permitted to enter air port **102** of the cylinder **90**, it also enters air port **105** of the cylinder **88** to drive the respective pistons **94** inwardly toward one another extracting the locking pins **84** and **86** from their respective keepers thereby unlocking the arms **26a** and **28a** of the carriage frame.

Pivotally mounted on the locking pins **84** and **86** is a subframe **106** on which is carried a tray **108**, a feed roller **110** and the coater roller **112**. The liquid coating material is contained in the tray **108** and is picked up by the feed roller **110** and applied to the coater roller **112** in the usual and well known manner. The coater roller is then adapted to contact the blanket cylinder **14** to apply the coating material to the blanket cylinder.

It is important to note that the locking pins **84** and **86** form the pivotal axis of the subframe **106** and when these pins enter their respective keeper holes **80a** and **82a**, the pivotal axis of the subframe and of the coater roller **112** will be accurately determined and will be firmly anchored in place relative to the press **12**, preventing movement of this pivotal axis during the coating operation.

When the coater frame has been moved to its lowermost position adjacent the blanket cylinder **14**, and the arms **26a** and **28a** have been locked in their position. As previously described, the coater roller **112** will be positioned in spaced relationship with the blanket cylinder **14**. In order to bring the coater roller into contact with the blanket cylinder **14**, the subframe **106** is pivoted about the now firmly anchored locking pins **84** and **86** from the position illustrated in FIG. **2** to the position illustrated in FIG. **3**. This pivoting or tilting movement of the subframe may be accomplished by means of an air cylinder **114** pivotally mounted on the subframe and having a moveable piston **116**. An operating rod **118** is pivotally connected to a rigid upstanding arm **120** mounted on the carriage **24**. The air cylinder is operated by an air valve **121** similar to valve **92**, previously described in connection with the locking mechanism. When the piston **116** is moved to is elevated position illustrated in FIG. **2**, the subframe is in its normal horizontal position with the coater roller **112** out of contact with the blanket cylinder **14**. When the piston **116** is moved to its lower position by the controlling air valve **121**, the subframe **106** will be pulled upwardly and tilted about the axis of the locking pins **84** and **86** to the position illustrated in FIG. **3** placing the coater roller in contact with the surface of the blanket cylinder **14**. So that this position may be accurately determined, it is preferred that there be a rigid arm **122** which extends forwardly to engage the frame of the press **12** when the subframe **106** has been tilted to its position as illustrated in FIG. **3**. In the illustrated embodiment, the air piston **114** is pivotally mounted on the subframe **106** so that when the subframe is tilted or pivoted about is axis, the air cylinder **114** may also be tilted about its axis.

The foregoing preferred embodiment has been described only by way of example and it will be appreciated that there are many modifications which can be made without departing from the spirit and scope of the invention as hereinafter claimed. For example, various other track arrangements can be employed for moving the carriage **24** up and down, and the means for forcibly moving the carriage along the tracks may also be varied. If desired, the rods **40** and **46** could be rendered moveable with the ball nuts **56** and **66** stationary. In this manner, the motor for rotating the rod **40** and **46** could be located on the track. However, this is not preferred. Various other and well known locking mechanisms could be used to lock the frame in its lowered position adjacent the blanket cylinder and various means other than that disclosed can be used to tilt the subframe into contact with the blanket cylinder.

The coater described herein solves the problem of how to provide a coater for the blanket cylinder where that blanket cylinder is recessed and where the rearward movement of the coater away from the blanket cylinder would be normally prohibited.

What is claimed is:

1. In a printing press having a recessed printing press cylinder, a coater for applying a liquid coating material to the printing press cylinder, said coater comprising a

frame, a tray mounted on said frame for holding a supply of coating material, roller means carried by said frame for transferring coating material from said tray to the printing press cylinder, track means attached to the printing press and extending from adjacent said printing press cylinder to a point remote from said printing press cylinder, frame moving means for moving said frame and said tray and roller means carried thereby along a first path defined by said track means into and out of position adjacent said printing press cylinder, and tray and roller moving means for moving said roller means along a second path which differs from and intersects said first path into and out of position for engagement with the printing press cylinder after said frame has been moved to its position adjacent said cylinder. whereby liquid coating material may be picked up from said tray and applied to said printing press cylinder by said roller means.

2. The structure of claim 1 wherein said track means comprising a pair of spaced parallel rectilinear tracks.

3. The structure of claim 2 wherein said tracks extend upwardly and rearwardly from adjacent said printing press cylinder.

4. The structure of claim 2 and further including frame locking means for locking said frame in position adjacent said printing press cylinder while permitting said tray and roller moving means to move said roller means transversely into and out of position for engagement with said printing press cylinder.

5. The structure of claim 1 wherein track-engaging roller means is provided on said frame for engaging said track means whereby said frame may be rollaby moved along said track means.

6. The structure of claim 1 wherein said frame moving means comprises

first threaded means on said frame,

second threaded means on said track means in threaded engagement with said first threaded means,

drive means for rotating one of said threaded means relative to the other, whereby said frame may be selectively moved along said track means toward and away from adjacent said printing press cylinder.

7. The structure of claim 6 wherein said first threaded means comprises at least one internally threaded nut member, and said second threaded means comprises at least one externally threaded rod member.

8. The structure of claim 7 wherein said nut member is journalled for rotation on said frame, said rod member is mounted in fixed position relative to said track means, and said drive means is operatively connected to said nut member to selectively rotate said nut member relative to said rod member.

9. The structure of claim 8 wherein said nut member is a ball nut.

10. The structure of claim 1 wherein said tray and roller moving means comprises, a subframe pivotally mounted on said frame and carrying said tray and roller means, and subframe moving means for pivotally moving said subframe between a first position wherein said roller means is out of engagement with said printing press cylinder and a second position wherein said roller means is in position for engagement with said cylinder.

11. The structure of claim 10 and further including stop means mounted on said subframe in position for engaging the printing press and stopping the pivotal movement of said subframe when said roller means has reached its position for engagement with said cylinder, whereby the coating position of said roller means may be accurately determined.

12. The structure of claim 10 wherein said subframe moving means comprises an air cylinder mounted on said frame having a moving piston operatively connected to said subframe.

13. The structure of claim 4 wherein said frame locking means comprises latch means carried on said frame, keeper means carried by said printing press and means for forcibly moving said latch means into said keeper means when said frame has been moved into a position adjacent said cylinder.

14. The structure of claim 13 wherein said means for forcibly moving said latch means includes at least one piston having a lost motion connection with said latch means, whereby said latch means may be driven by impact into and out of engagement with said keeper means.

15. The structure of claim 14 wherein said latch means includes a pair of latch pins on opposite sides of said frame, and said fluid actuated piston means comprises a pair of pistons, each having a lost motion connection with a respective one of said latch pins, and means for moving said pistons selectively in opposite directions, whereby said latch pins may be simultaneously driven by impact into and out of engagement with said keeper means.

16. In a printing press having a recessed printing press cylinder, a coater for applying a liquid coating material to the printing press cylnder, said coater comprising a frame, a subframe pivotally mounted on said frame and carrying a tray for holding a supply of coating material and roller means for transferring the coating material from said tray to the printing press cylinder, a pair of spaced tracks attached to the printing press and extending from adjacent said printing press cylinder to a point remote from said printing press cylinder, first drive means for moving said frame along said tracks toward and away from a position adjacent said printing press cylinder, means at the pivotal axis of said subframe for locking said frame in its position adjacent said printing press cylinder, whereby the pivotal axis of said subframe will be accurately fixed relative to the press, and second drive means for pivotally moving said roller means into and out of position for engagement with the printing press cylinder after said frame has been moved to and locked in its position adjacent said cylinder, whereby liquid coating material may be picked up from said tray and applied to said printing press cylinder.

17. In a printing press having a recessed printing press cylinder, a coater for applying a liquid coating material to the printing press cylinder, said coater comprising a frame, a tray mounted on said frame for holding a supply of coating material, roller means carried by said frame for transferring coating material from said tray to the printing press cylinder, track means attached to the printing press and extending from adjacent said printing press cylinder to a point remote from said printing press cylinder, frame moving means for moving said frame and said tray and roller means carried thereby along said track means into and out of position adjacent said printing press cylinder, and tray and roller moving means for moving said roller means into and out of position for engagement with the printing press cylinder after said frame has been moved to its position adjacent said cylinder, whereby liquid coating material may be picked up from said tray and applied to said printing

press cylinder by said roller means, said frame moving means comprising a pair of internally threaded nut members journalled for rotation on opposite sides of said frame, a pair of spaced parallel externally threaded rods mounted in fixed position relative to said track in threaded engagement with said nut members, and drive means operatively interconnecting said nut members for rotating said nut members in unison relative to said rods selectively in one direction to move said frame along said track means toward said printing press and in the opposite direction to move said frame away from said printing press.

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(54) Slip sheet insertion-delivery apparatus for sheet-fed printing press.

(57) In a slip sheet insertion-delivery apparatus, a plurality of printing sheet grippers opposite to some of a plurality of gripper pads mounted on a gripper pad shaft and slip sheet grippers opposite to the remaining gripper pads are mounted on one gripper shaft. The slip grippers are loosely fitted on the gripper shaft through corresponding torsion springs. A cam mechanism is arranged to simultaneously open/close the printing and slip sheet grippers near a cylinder. Another cam mechanism including a plurality of cams is arranged to simultaneously open/close only the slip sheet grippers at a slip sheet insertion position.

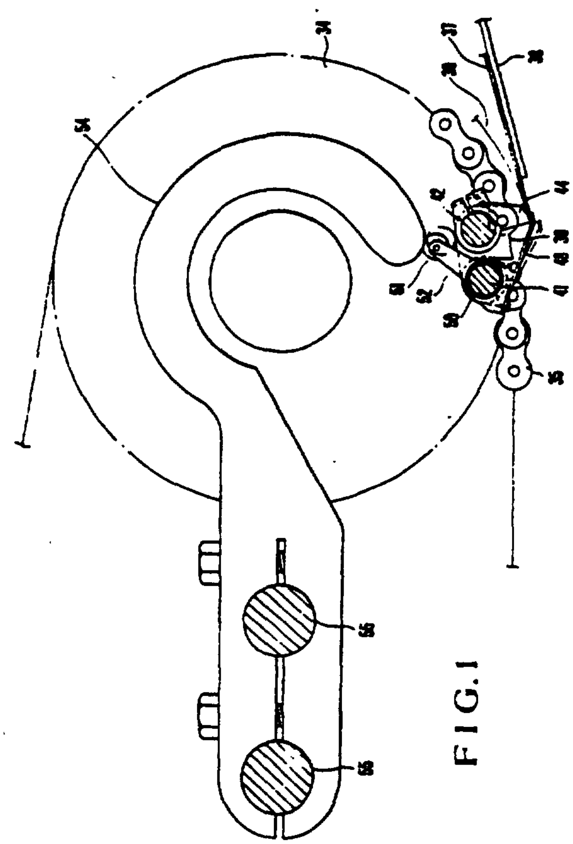

FIG.1

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Slip Sheet Insertion-Delivery Apparatus For Sheet-fed Printing Press

Background of the Invention

The present invention relates to a slip sheet insertion-delivery apparatus for inserting and delivering a slip sheet between adjacent printing sheets in order to prevent offsetting when sheets are delivered and stacked in a sheet-fed printing press.

In a sheet-fed printing press, a sheet conveyed by a delivery chain after printing is released at a rear end of a convey path and is dropped and stacked on a stack board. However, an ink on a sheet immediately after printing is not yet dried, and if such sheets are stacked in this state, offsetting occurs. In order to prevent this, in a conventional printing press, powder is sprayed on a printed surface between a printing apparatus and a delivery apparatus or a printed surface is dried upon radiation of an infrared ray.

However, like in intaglio printing, a thickness of an ink film on a printed surface reaches several tens of microns, i.e., about ten times that in a lithographic printing press. In this case, even through a printed surface is forcibly dried by an infrared ray, drying is not sufficient. If powder is sprayed on a printed surface, quality of a printed product is degraded. Therefore, a slip sheet insertion-delivery apparatus which inserts a slip sheet between adjacent printing sheets when the sheets are delivered on a stack board has been conventionally used.

Figs. 6 and 7 show a conventional slip sheet insertion-delivery apparatus. In Figs. 6 and 7, a plurality of pairs of right and left gripper rod holders 2 are disposed at predetermined intervals between a pair of right and left delivery chains 1 which travel while circulating between a printing apparatus and a delivery apparatus. A gripper rod 6 consisting of a stationary gripper pad shaft 3, a pivotal printing sheet gripper shaft 4 and a pivotal slip sheet gripper shaft 5 is axially supported between each pair of right and left gripper rod holders 2. A plurality of gripper pads 7 are parallelly split-fixed on the gripper pad shaft 3. A plurality of printing sheet grippers 8 and slip sheet grippers 9 are parallelly split-fixed to the gripper shafts 4 and 5, respectively, to have different phases as those of the gripper pads 7. Cam levers 12 and 13 on which cam followers 10 and 11 are pivotally mounted on their free end portions, respectively, are axially mounted on the shaft end portions of the gripper shafts 4 and 5. Upon traveling of the delivery chains 1, the cam followers 10 and 11 face cams provided near a printing cylinder on the side of a frame at a delivery position, so as to open the grippers at a predetermined timing.

With the above arrangement, when the delivery chains 1 travel and the cam follower 10 is in contact with the cam near the printing cylinder, only the printing sheet grippers 8 are opened and closed to regrip the printing sheet from the grippers of the printing cylinder. Then, the sheet is conveyed to be gripped by the printing sheet grippers 8 and the gripper pads 7. Upon regripping, since the slip sheet grippers 9 are kept closed, a sheet 14 is gripped by the printing sheet grippers 8 to cover the slip sheet grippers 9, as shown in Fig. 8. When the gripped edge of the sheet 14 conveyed in this manner has reached in front of the stack board, a slip sheet is fed onto a feeder board, and the cam follower 11 faces the corresponding cam, so that the slip sheet grippers 9 are opened and closed while causing the printing sheet 14 to leap up, and grip the slip sheet between themselves and the gripper pads 7. Thereafter, when the slip sheet has reached the stack board, the grippers 8 and 9 are simultaneously opened to deliver the printing sheet 14 and the slip sheet to overlap each other.

However, in the conventional slip sheet insertion-delivery apparatus, since each pair of the gripper rods 6 comprise the two gripper shafts 4 and 5 for the printing sheet and the slip sheet, the overall traveling mechanism including the gripper rod holders 2 is heavy, thus interfering with high-speed and smooth operation. As described above, the printing sheet 14 covers the slip sheet grippers 9, as shown in Fig. 8. When the slip sheet is gripped, the slip sheet grippers 9 must be opened while causing the printing sheet 14 to leap up, the printing sheet 14 is easily torn. In order to prevent this, a pitch indicated by p in Fig. 8 between the grippers 8 and 9 must be increased or a gripping margin of the slip sheet gripper indicated by t in Fig. 7 must be decreased. Therefore, paper sheets may be wasted due to misgripping. Thus, the operation is unstable, and adjustment is not easy.

Summary of the Invention

It is a principal object of the present invention to provide a slip sheet insertion-delivery apparatus for a sheet-fed printing press, which can realize a high-speed, smooth operation and allows easy adjustment.

It is another object of the present invention to provide a slip sheet insertion-delivery apparatus for a sheet-fed printing press, wherein a printing sheet

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can be prevented from being torn by slip sheet grippers and hence a stable operation can be performed.

In order to achieve the above objects, there is provided a slip sheet insertion-delivery apparatus for a sheet-fed printing press, comprising a plurality of delivery gripper rods supported between right and left delivery chains at predetermined intervals and each consisting of a gripper shaft and a gripper pad shaft, a plurality of gripper pads arranged along each of the gripper pad shafts, a plurality of printing sheet grippers fixed on each of the gripper shafts at positions corresponding to some of the plurality of gripper pads, a plurality of slip sheet grippers loosely fitted on each of the gripper shafts through torsion springs at positions corresponding to the remaining gripper pads, a cam mechanism for reciprocally pivoting each of the gripper shafts through a predetermined angle at a regripping position from a cylinder so as to simultaneously open/close the printing sheet grippers and the slip sheet grippers and another cam mechanism comprising a plurality of cams with which cam followers of the slip sheet grippers are in contact, for opening/closing only the slip sheet grippers at a slip sheet insertion position.

Brief Description of the Drawings

Figs. 1 to 5 show a slip sheet insertion-delivery apparatus for a sheet-fed printing press according to an embodiment of the present invention, in which

Fig. 1 is a side view of a portion near a slip sheet insertion position of an intaglio printing press to which the present invention is applied,

Fig. 2 is a side view of a portion near grippers and gripper pads in an upper travel portion of a delivery chain,

Fig. 3 is a plan view of Fig. 2,

Fig. 4 is a schematic plan view of the overall apparatus, and

Fig. 5 is a schematic side view of an intaglio printing press to which the present invention is applied; and

Figs. 6 to 8 show a conventional slip sheet insertion-delivery apparatus in a sheet-fed printing press, in which

Fig. 6 is a schematic plan view of the apparatus,

Fig. 7 is an enlarged sectional view taken along a line A-A in Fig. 6, and

Fig. 8 is a schematic front view when viewed from a direction B in Fig. 6.

Description of the Preferred Embodiment

An embodiment of the present invention will be described with reference to Figs. 1 to 5.

As shown in Fig. 5, in a printing unit 20 of the printing press, a copperplate cylinder 21 having an outer surface on which a copperplate is mounted, and an impression cylinder 23 which comprises four arrays of a plurality of grippers 22 in gaps of the outer peripheral surface thereof are arranged so that their surfaces oppose each other. A form roller 25 of an inking apparatus 24 and a wiping roller 26 are in contact with the copperplate cylinder 21. A feedboard 28 comprising a front lay 27 at its front end portion is supported obliquely above the impression roller 23 through swing grippers 29.

With the above arrangement, a printing sheet 30 fed onto the feedboard 28 in a paper sheet feeder is vertically registered by the front lay 27, and is then gripped by the swing grippers 29. Then, the sheet 30 is regripped by the grippers 22 of the impression cylinder 23 and then passes between the impression cylinder 23 and the copperplate cylinder 21. In this case, an image is formed on the plate surface of the copperplate cylinder 21 by cooperation of the inking apparatus 24 and the wiping roller 26. The image is transferred onto the printing sheet 30 passing between the cylinders 23 and 21, thus performing printing.

A delivery cylinder 31 is in contact with the surface of the impression cylinder 23, and a pair of right and left delivery chains 35 are looped between a pair of right and left sprockets 32 coaxially provided on the delivery cylinder 31 and sprockets 34 of a delivery apparatus 33. A vertically movable stack board 36 is disposed in the delivery apparatus 33, and a distal end of a feedboard 38 on which a slip sheet 37 fed from the paper sheet feeder is slid and stopped is arranged adjacent to the end of the delivery chains 35. A plurality of substantially rectangular gripper rod holders 39 are fixed to the delivery chains 35 at predetermined intervals. A stationary gripper pad shaft 41 and a pivotal gripper shaft 42 constituting a gripper rod 40 are axially supported between the right and left gripper rod holders 39. Reference numerals 43 denote coupling plates which are located at a plurality of positions of each gripper rod 40 and are fixed to the gripper pad shaft 41. A hole formed on each coupling plate 43 pivotally supports the corresponding gripper shaft 42, thus regulating flexure of the gripper shaft 42. A plurality of gripper pads 44 are split-fixed onto the gripper pad shaft 41 at substantially predetermined intervals. A cam lever 46 having a cam follower 45 at its free end portion is axially mounted on the shaft end portion of the gripper shaft 42. A plurality of printing sheet grippers 47 and a plurality of slip sheet grippers 48

having substantially the same structure are alternately arranged on the gripper shaft 42 to face some gripper pads 44 and the remaining gripper pads 44, respectively. The printing sheet grippers 47 of the grippers 47 and 48 are fixed to the gripper shaft 42, and are pivoted integrally with the gripper shaft 42. Each slip sheet gripper 48 is pivotally fitted on the gripper shaft 42 and is biased by a pivoting force in a gripper closing direction as a counterclockwise direction in Fig. 2 by torsion coil springs 50 interposed between adjacent collars 49. Each slip sheet gripper 48 is integrally formed with a cam lever 52 on which a cam follower 51 is pivotally supported at its free end portion, and an inclination angle of the cam lever 52 indicated by 8 in Fig. 2 is formed to be substantially the same as that of the cam lever 46. Figs. 3 and 4 illustrate the cam lever 52 in detail. A single cam 53 having an arcuated cam surface which is almost concentrical with the sprockets 32 and 34, and a plurality of cams 54 are disposed near the sprockets 32 as a regripping portion from the impression cylinder 23 and near the sprockets 34 corresponding to a slip sheet insertion position so that the cam follower 45 and a plurality of cam followers 51 face the corresponding cam surfaces. The cam 53 is fixed to the frame. However, the cams 54 are stationary supported on a stay 55 coupling the right and left frames. When the delivery chains 35 travel and the cam follower 45 is brought into contact with the cam surface of the cam 53, the gripper shaft 42 is pivoted to simultaneously open all the printing sheet grippers 47 and the slip sheet grippers 48. Thereafter, the grippers 47 and 48 are simultaneously closed. As a result, a printing sheet 30 is gripped by both the printing sheet grippers 47 and the slip sheet grippers 48. When the grippers 47 and 48 gripping the printing sheet 30 have reached the cams 54 and the cam followers 51 face the cam surfaces of the corresponding cams 54, the slip sheet grippers 48 are opened against the biasing force of the torsion coil springs 50, and thereafter, the slip sheet grippers 48 are closed to grip the slip sheet 37 on the feedboard 38. A delivery cam 56 is provided on the frame above the stack board 36 in correspondence with the cam follower 45. When the grippers 47 and 48 gripping the printing sheet 30 and the slip sheet 37 pass by the center of the stack board 36, the cam follower 45 is brought into contact with the cam surface of the delivery cam 56, and the printing sheet grippers 47 and the slip sheet grippers 48 are simultaneously opened and deliver the printing sheet 30 and the slip sheet 37 onto the stack board 36 to overlap each other.

A delivery operation of the printing press with the above arrangement will be described. The printing sheet 30 and the slip sheet 37 are fed onto the feedboards 18 and 38 at predetermined timings to start a printing operation. As described above, the printing sheet subjected to intaglio printing is gripped by the grippers 22, and the gripped edge of the sheet reaches a contact point with the delivery cylinder 31. At this time, since the cam follower 45 is brought into contact with the cam surface of the cam 53, the printing sheet grippers 47 and the slip sheet grippers 48 are simultaneously opened and are then closed, and the grippers 22 are opened. Therefore, the printing sheet 30 is regripped by both the grippers 47 and 48. Upon traveling of the delivery chains 35, when the printing sheet 30 which is conveyed while being gripped by the grippers 47 and 48 has reached a slip sheet insertion position, all the cam followers 51 are in contact with the corresponding cam surfaces of the cams 54 at the same time, and the slip sheet grippers 48 are opened against the biasing force of the torsion coil springs 50. Thereafter, the cam followers 51 pass by the cam surfaces and the grippers 48 are closed. The slip sheet grippers 48 grip the slip sheet 37 on the feedboard 38. As a result, the printing sheet 30 and the slip sheet 37 are gripped by the grippers 47 and 48 while normally overlapping each other. The conveyed sheets 30 and 37 are released from the grippers 47 and 48 when the cam follower 45 is in contact with the cam surface of the delivery cam 56 to simultaneously open the grippers 47 and 48. Then, the sheets 30 and 37 are dropped and stacked on the stack board 36. More specifically, since the printing sheets 30 and the slip sheets 37 are alternately stacked on the stack board 36, no offsetting occurs. The grippers 47 and 48 releasihg the sheets 30 and 37 are closed when the cam surface is ended, and are moved toward the printing unit.

In this manner, when the printing sheet 30 is regripped from the grippers 22 of the impression cylinder 23, the sheet 30 is gripped by both the grippers 47 and 48, and at the slip sheet insertion position, only the slip sheet grippers 48 are opened to grip the slip sheet 37. Therefore, when the slip sheet grippers 48 are opened, they do not cause the printing sheet 30 to leap up unlike in the conventional apparatus.

As can be understood from the above description, according to the present invention, in a slip sheet insertion-delivery apparatus for a sheet-fed printing press, a plurality of printing sheet grippers facing some of a plurality of gripper pads arranged along a gripper pad shaft and a plurality of slip sheet grippers facing the remaining gripper pads are arranged along a single gripper shaft. The printing sheet grippers are fixed to the gripper shaft, and the slip sheet grippers are loosely fitted on the gripper shaft through torsion coil springs. The printing sheet grippers and the slip sheet

grippers are simultaneously opened/closed by a cam mechanism arranged near a printing cylinder, and only the slip sheet grippers are opened/closed by another cam mechanism arranged at a slip sheet insertion position. Thus, a printing sheet released from the grippers of the printing cylinder are regripped and conveyed by both the printing sheet grippers and the slip sheet grippers, and at the slip sheet insertion position, only the slip sheet grippers are opened to grip a slip sheet. The slip sheet grippers can be prevented from tearing the printing sheet when they are opened. Therefore, a pitch between adjacent grippers can be decreased, and a gripping margin of the grippers can be increased. The number of wasted sheets due to misgripping can be decreased, and adjustment of a regripping timing can be facilitated like in a non-slip sheet version printing press. Since the printing sheet is gripped by both the printing sheet grippers and the slip sheet grippers over a long distance, an ideal number and arrangement of grippers like in a non-slip sheet version printing press need not be modified. Since the two gripper shafts in the conventional apparatus can be reduced to one, and other components can also be omitted accordingly. Therefore, the overall gripper rod can be light in weight. Thus, a high-speed, smooth operation can be allowed, thereby improving productivity. In addition, wear of delivery chains can be reduced, resulting in advantages in maintenance.

Claims

1. A slip sheet insertion-delivery apparatus for a sheet-fed printing press, comprising:

a plurality of delivery gripper rods supported between right and left delivery chains at predetermined intervals and each consisting of a gripper shaft and a gripper pad shaft;

a plurality of gripper pads arranged along each of said gripper pad shafts;

a plurality of printing sheet grippers fixed on each of said gripper shafts at positions corresponding to some of said plurality of gripper pads;

a plurality of slip sheet grippers loosely fitted on each of said gripper shafts through torsion springs at positions corresponding to the remaining gripper pads;

a cam mechanism for reciprocally pivoting each of said gripper shafts through a predetermined angle at a regripping position from a cylinder so as to simultaneously open/close said printing sheet grippers and said slip sheet grippers; and

another cam mechanism comprising a plurality of cams with which cam followers of said slip sheet grippers are in contact, for opening/closing only said slip sheet grippers at a slip sheet insertion position.

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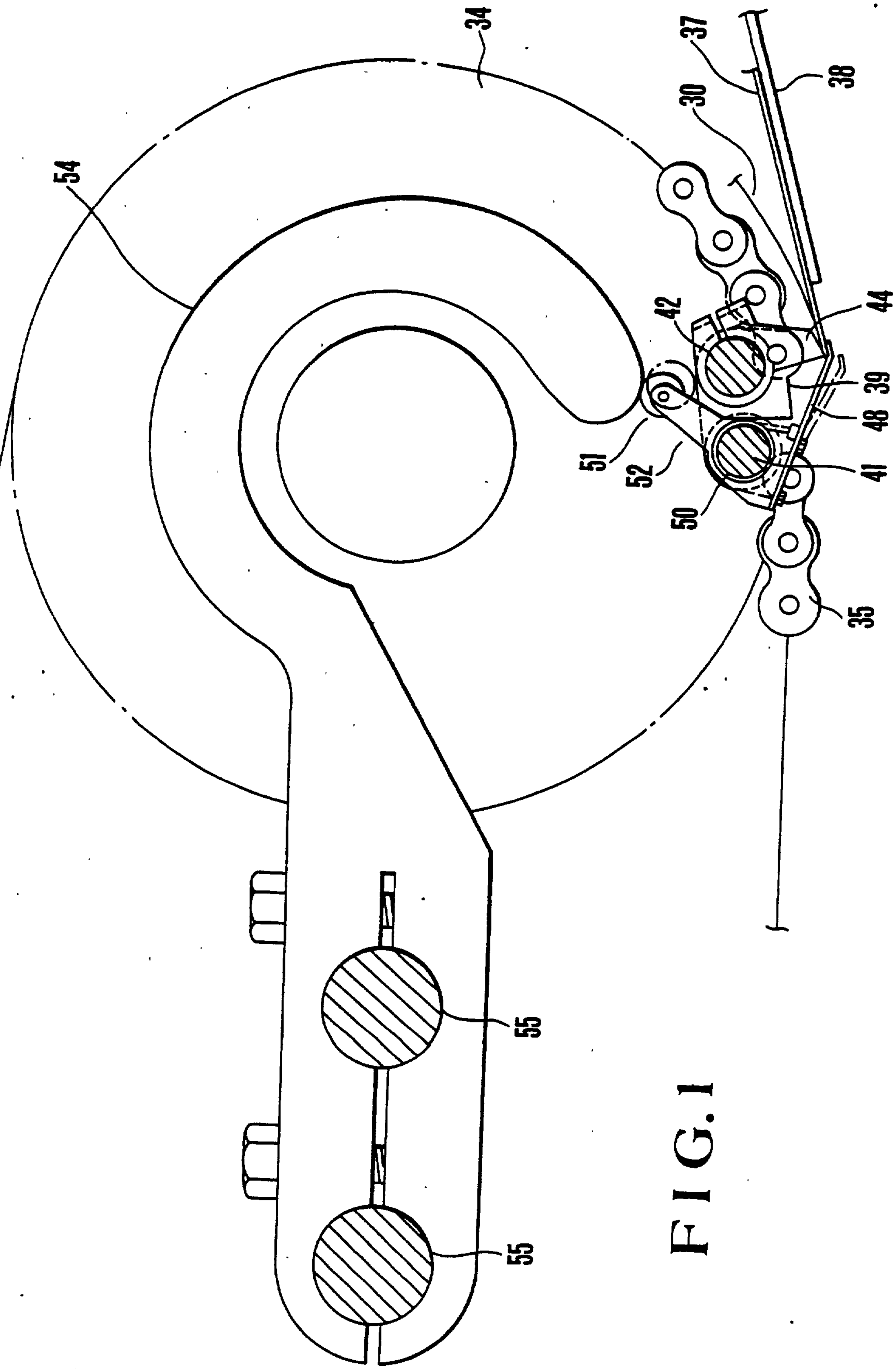

FIG. 1

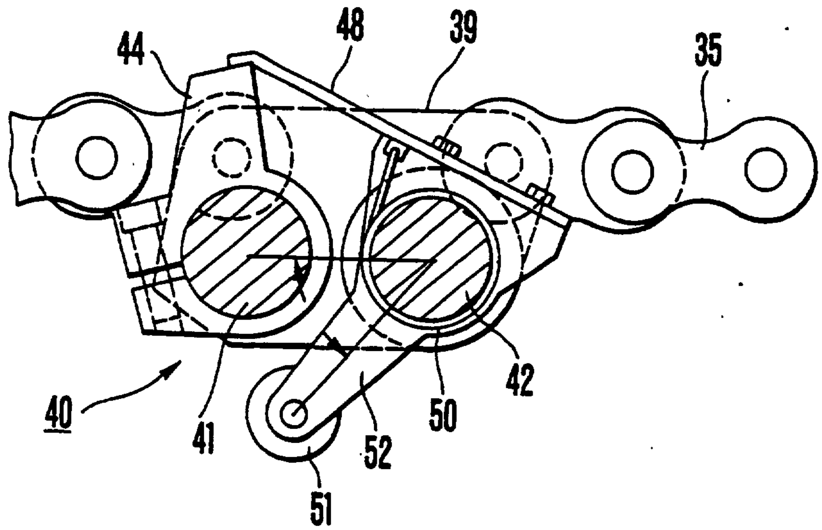

FIG.2

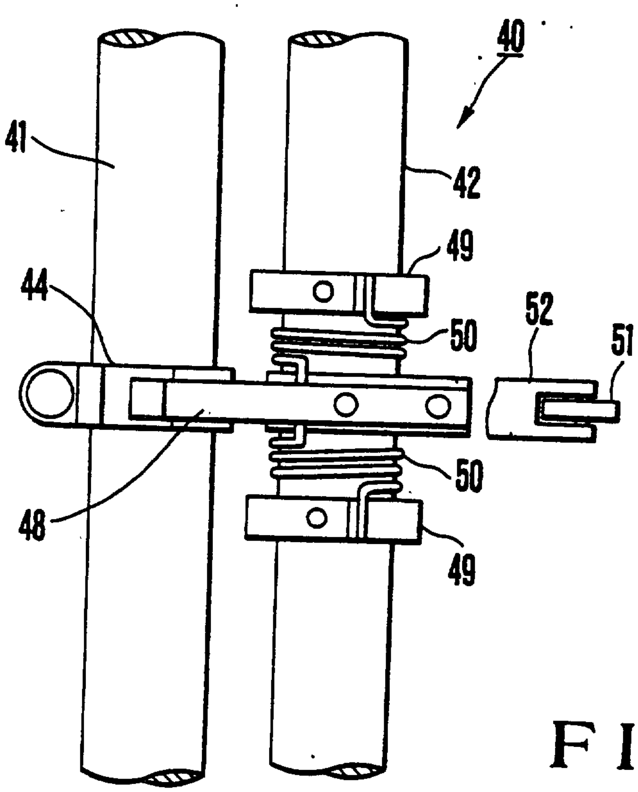

FIG.3

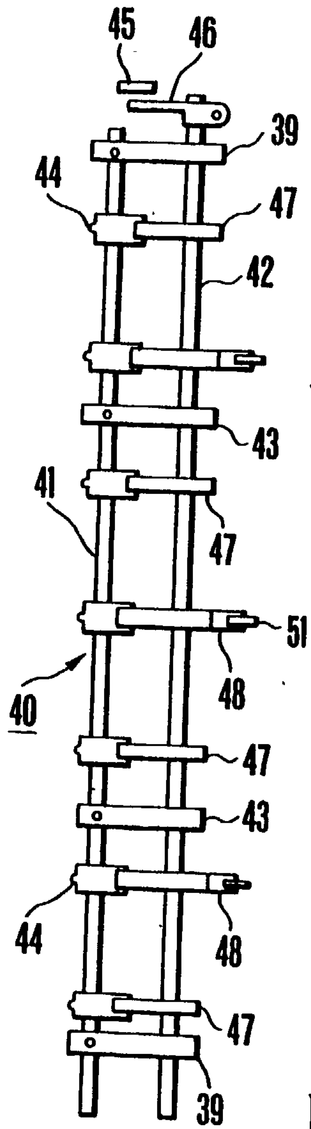

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FIG.4

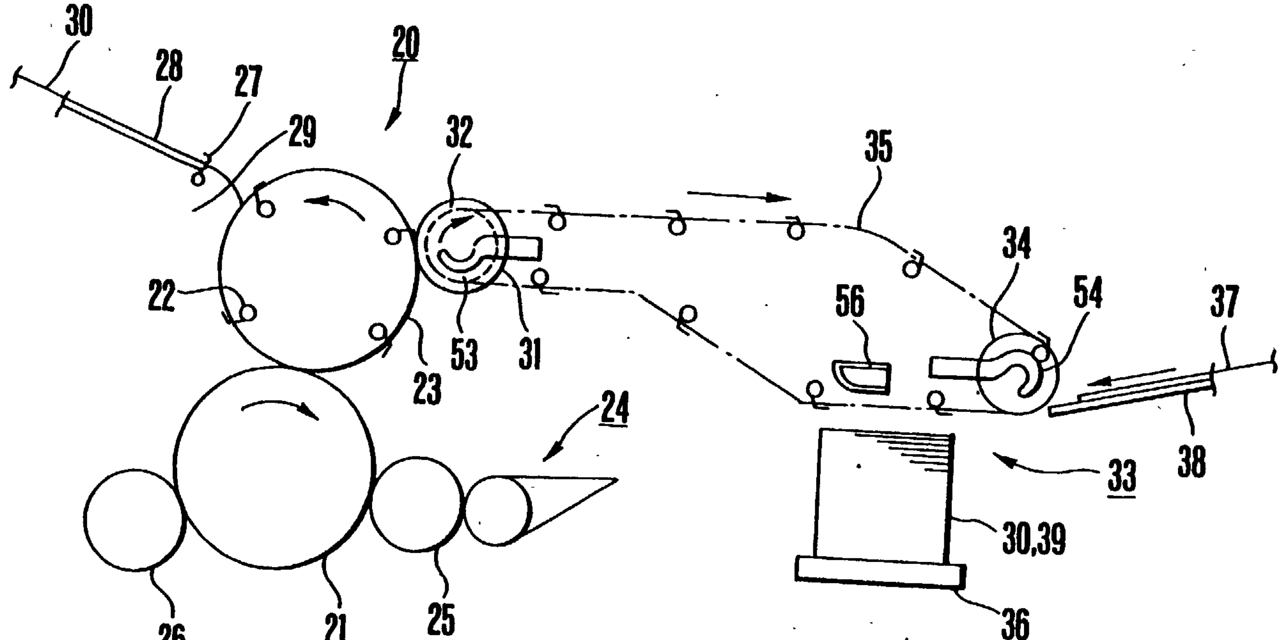

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FIG.5

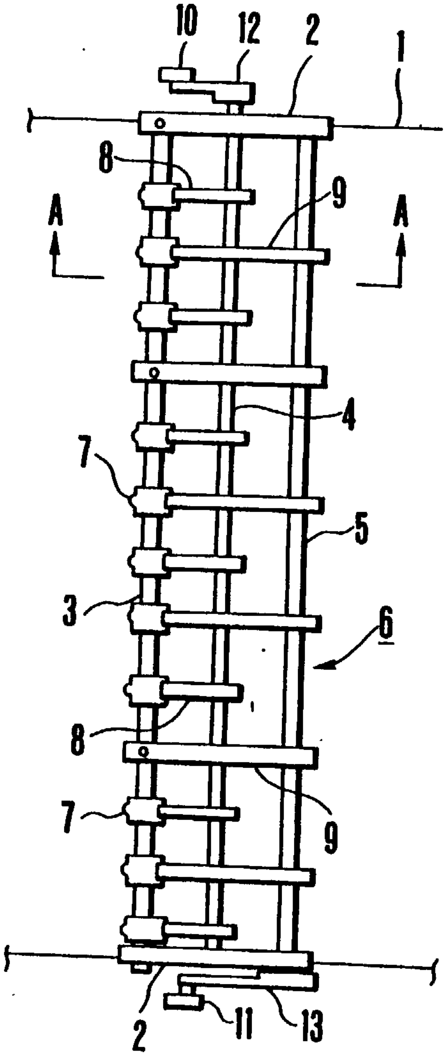

FIG.6

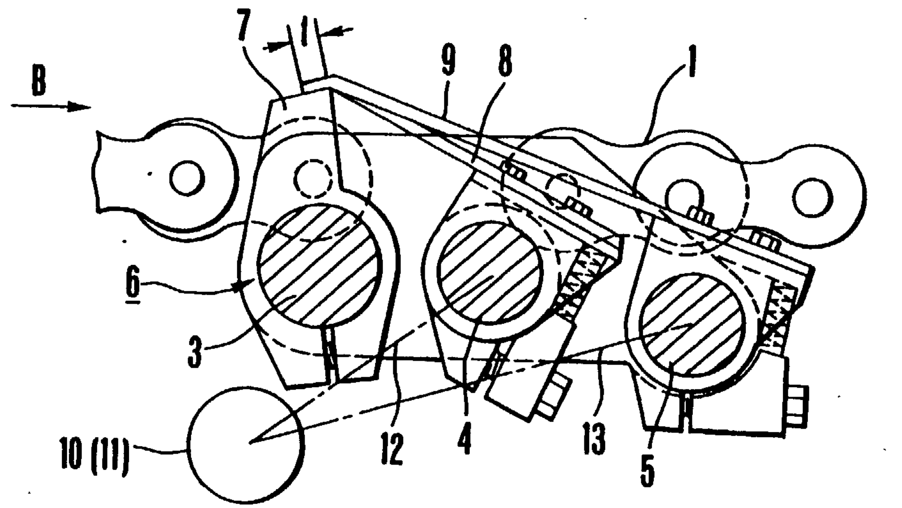

FIG.7

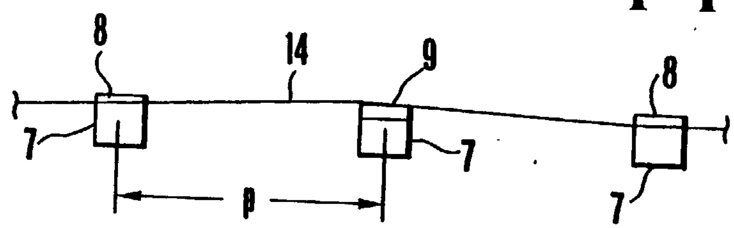

FIG.8

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⑲ Europäisches Patentamt
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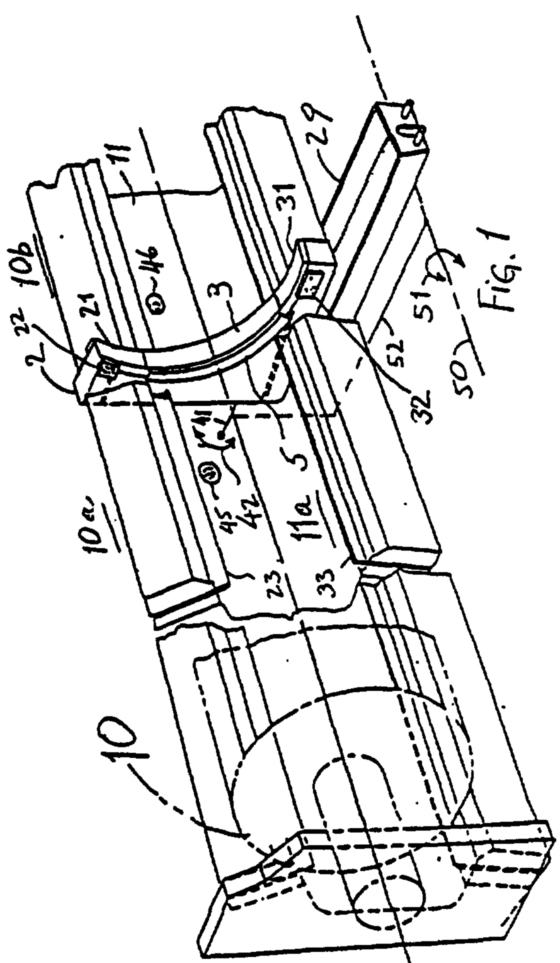
㊹ **Geteilter Farbkasten für eine Flexodruckmaschine.**

㊿ Um einen Flexo-Farbkasten in axiale Zonen (10a, 10b, ...) unterteilen zu können, damit Druckfarben mit verschiedenen Eigenschaften, beispielsweise in verschiedenen Farben entlang der axialen Zonen einer Aniloxwalze (10) angewandt werden können, besitzt ein Trennelement (2) ein Einsatzstreifenelement (3), das sich über einen Teil des Umfangs der Aniloxwalze erstreckt und mit dieser, beispielsweise über zusammengedrückten Silikongummi (5), in elastischer Berührung steht. Angrenzend an die Enden des Streifenelements (5) befinden sich zwei Filzkissen (21, 31), die einen ringförmigen Trennflüssigkeitsfilm auf die Aniloxwalze aufbringen. An einer Trogstruktur sind zwei Rakeln angebracht, die abhängig von der Drehrichtung der Aniloxwalze selektiv von ihrer Anlage an der Oberfläche der Aniloxwalze abgehoben werden können. Außerdem können die Rakeln beide von der Oberfläche der Aniloxwalze abgehoben werden.



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"GETEILTER FARBKASTEN FÜR EINE FLEXODRUCKMASCHINE"

Die vorliegende Erfindung bezieht sich auf Druckmaschinen, im besonderen auf Flexodruckmaschinen, und speziell auf ein Farbsystem oder einen Farbkasten für solche, wobei der Farbakasten axial in verschiedene Zonen unterteilt ist, um zu ermöglichen, in den betreffenden Zonen verschiedenfarbige Druckfarben für die entsprechenden Zonen einer Auftrag- oder Aniloxwalze zu verwenden.

Technologischer Hintergrund:

Flexodruckmaschinen werden auf dem Gebiet des Druckereiwesens in zunehmendem Maße benutzt. Üblicherweise verwendet man Flexodruckmaschinen zum Bedrucken von Beuteln, Verpackungsmaterialien, Kartonnagen und Schachteln. In neuerer Zeit wird der Flexodruck außerhalb des Verpackungsbereichs angewandt, hauptsächlich für Bücher, Zeitschriften, Geschäftsdrucksachen und dergleichen. Eine gute Besprechung des Flexodrucks findet man in "Maschinendruck" (Machine Printing) von Durrant, Meacock und Whitworth, Copyright 1973 bei Hastings House Publishers, New York, N.Y.

Es ist schon früher vorgeschlagen worden, Druckfarben mit verschiedenen Merkmalen, beispielsweise in verschiedenen Farben, hinsichtlich konkreter Zonen auf einer Farbduktorwalze zu trennen, an der mindestens eine oder üblicherweise zwei Rakeln angreifen, siehe z.B. die U.S.-Anmeldung, Serialnummer 921.338, eingereicht am 21. Oktober 1986, von Batke und anderen. Diese Anmeldung bezielt sich auf ein System, in dem unter einer sich axial erstreckenden Rakel eine Trennplatte angeordnet ist. Die Trennplatte besitzt, an dieser befestigt, ein Abdichtelement, das elastisch an der Unterseite zweier dem Duktor oder der Trogwalze aus verschiedenen Richtungen gegenüberstehenden Rakeln angreift, die den Betrieb des Duktors oder der Trogwalze in beiden Drehrichtungen ermöglichen. An der Kante, welche an den Rakeln anliegt, ist eine reibungsarme Oberfläche angebracht, wobei das abdichtende Element den Raum zwischen den Rakeln überbrückt und das Element mit dem Umfang des Duktors oder der Trogwalze zusammengepaßt ist. Die Rakeln erstrecken sich axial über die Abdichtelemente hinaus. Die Trennplatten und die Abdichtelemente können an Einheiten montiert werden, die effektiv entlang dem Farbkasten und somit entlang dem Duktor oder der Trogwalze angeordnet sind, und zwar in so gewählten Positionen, wie es die axiale Erstreckung der verschiedenfarbigen Druckfarbenzonen erfordert.

Die deutsche Patent-Offenlegungsurkunde DE-OS 23 20 638, auf die in der vorerwähnten Patentanmeldung von Batke Bezug genommen wird, beschreibt eine Anordnung, bei der zwei die Druckfarben trennende Blechelemente durch eine Federkraft direkt an den Umfang eines Duktors angestellt werden, um verschiedenfarbige Druckfarben voneinander zu trennen. Die Querabdichtung des Druckfarbenbehälters oder Farbsumpfs wird hergestellt, indem man die Trennelemente gegen die gegenüberliegende Oberfläche der Rakeln oder Abstreifmesser anstellt.

<u>Die Erfindung:</u>

Sie hat zur Aufgabe , eine flexible Einrichtung zum Trennen axialer Zonen auf einer Aniloxwalze für eine Flexo-Druckmaschine zu schaffen, so daß Druckfarben mit verschiedenen Merkmalen, beispielsweise in verschiedenen Farben, ohne Überlappung auf die betreffenden Zonen aufgebracht werden können, wobei die Einrichtung einfach und kostengünstig ist und für eine wirksame Abdichtung der axialen Zonen gegeneinander sorgt.

Kurz gesagt, ein trennendes Streifenelement, vorzugsweise mit einer reibungsarmen Oberfläche, hat eine gekrümmte Fläche, die gegenüber der Oberfläche der Aniloxwalze angebracht ist und mit dieser zusammenpaßt. Die gekrümmte Fläche erstreckt sich über einen Teil des Walzenumfangs. Um die Druckfarben mit verschiedenen Eigenschaften eindeutig zu trennen und so eine Wanderung der Farbe zwischen den beiden oder mehreren Druckfarbenzonen zu verhindern und den Abriebeffekt der auf Wasserbasis hergestellten Druckfarben zu eliminieren, wird zwischen das Streifenelement und die Oberfläche der Aniloxwalze ein dünner Film einer wässerigen Flüssigkeit eingebracht. Typisch ist das Streifenelement aus Teflon hergestellt, und die Flüssigkeit ist Wasser. Andere Flüssigkeiten, wie Wasser-Alkoholgemische oder Druckfarben-Lösungsmittel können benutzt werden. Der Flüssigkeitsfilm wird in den Bereich unter dem Streifen so eingebracht, daß zwei mit Flüssigkeit tränkbare Elemente neben den Enden des Streifenelements angebracht werden. Ein bevorzugtes Material ist Filz; andere schwammartige Werkstoffe können benutzt werden. Die Flüssigkeit wird den Filzelementen zugeführt, die als Dochte wirken und den dünnen Flüssigkeitsfilm genau in den Bereich des Trennstreifens einbringen.

In Übereinstimmung mit einer vorteilhaften Ausgestaltung der Erfindung ist das Streifenele-

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ment rückseitig mit beispielsweise Silikongummi mit einem niedrigen Durometerwert hinterfüttert. Das ermöglicht der Dichtung, sich unabhängig von der Drehrichtung der Aniloxwalze selbsttätig einzustellen.

Aniloxwalzen werden üblicherweise mit Rakeln benutzt. Gemäß einer weiteren vorteilhafter Ausgestaltung der dem Erfindung werden die Rakeln beschnitten oder so ausgeführt, daß sie an den Trennelementen enden. Die Gummihinterfütterung ermöglicht das Abdichten der Rakelecken in den Druckfarbenkammern neben den Farben-Trennelementen und somit auch das wirkungsvolle Abdichten der Rakelkanten, und zwar durch das plastische Verformen des Silikongummis, d.h. durch das Vorwölben über die Kante bei Druckanwendung.

In Übereinstimmung mit einer weiteren vorteilhaften Ausgestaltung der Erfindung ist das Farbsystem so angeordnet, daß eine Haltestruktur für die Trennenden Streifenelemente, für die Gummihinterfütterung und für die Filzkissen oder, vorzugsweise, der ganze Farbkasten so bewegt werden können, daß wahlweise eine der beiden Rakeln mit der Aniloxwalze in Berührung steht, und zwar abhängig von der Drehrichtung der Aniloxwalze, und daß ferner die Bewegung so erfolgen kann, daß beide Rakeln die Aniloxwalze freigeben, während das Trennelement und, vorzugsweise, auch die Kissen mit der Oberfläche der Aniloxwalze in Berührung bleiben. Das hat den Vorteil, daß während der Perioden, in denen nicht gedruckt wird, die Aniloxwalze weiter rotieren kann, wobei die Farbe im Farbkasten umgewälzt und dadurch einem Antrocknen der Farbe an der Aniloxwalze vorgebeugt wird, jedoch ohne daß eine der Rakeln mit der Aniloxwalze in Berührung steht, wodurch die Abnutzung sowohl der Aniloxwalze als auch der betreffenden Rakel oder Rakeln wesentlich herabgesetzt wird.

ZEICHNUNGEN:

Abb. 1 ist eine perspektivische Gesamtansicht eines Flexo-Farbwerks (wobei die Aniloxwalze als Phantombild angedeutet ist), das Farbwerk ist gemäß der vorliegenden Erfindung axial aufgeteilt.

Abb. 2 ist ein schematischer Schnitt senkrecht zur Achse einer Aniloxwalze, in dem die Druckfarben-Trenneinrichtung gemäß der vorliegenden Erfindung dargestellt ist.

Eine Aniloxwalze 10 in Standardausführung mit beispielsweise etwa 28 cm (ungefähr 11") Durchmesser ist in axiale Zonen unterteilt, entsprechend den axialen Zonen 10a, 10b oder mehr, je nach den Erfordernissen des Farbkastens. Ein Trennelement 2, beispielsweise aus Kunststoff - wofür Nylon geeignet ist - ist in einem geeigneten Bauteil des Farbkastens, der nur schematisch durch 11 dargestellt ist, mit Schrauben 12 befestigt. Der Farbkasten 11, der einen Farbenhohlraum 11a definiert, ist in bekannter Weise am Maschinenrahmen befestigt. Er kann um eine zur Ebene der Abb. 2 senkrechte Achse 11b (Abb. 2) etwas pendeln. Das Trennelement ist schmal, und es erstreckt sich über einen Teil des Umfangs der Aniloxwalze 10. Das Trennelement 2 ist mit einer Ausnehmung 13 ausgeführt, in die eine Teflondichtung 3 eingesetzt ist, die rückseitig durch eine Hinterfütterung 5 aus Silikongummi gestützt wird. Bei Zeitungsdruck ist eine Breite der Elemente 3 und 5 von etwa 15 mm geeignet.

Das Silikongummi-Hinterfütterungselement 5 verteilt den Druck des Nylon-Trennstreifens 3 gleichmäßig über den Umfang der Aniloxwalze. Die zusammendrückende Kraft im Silikongummi kann durch Gegendrücken gegen die Aniloxwalze 10 erzeugt werden. Damit kann der Druck des Trennstreifens 3 gegen die Aniloxwalze gesteuert werden.

Erfindungsgemäß wird ein dünner Flüssigkeitsfilm - typisch ist Wasser - zwischen die Aniloxwalze 10 und den Teflon-Trennstreifen 3 gebracht. Dieser dünne Wasserfilm kommt von zwei Filzkissen 21, 31, die mit Wasser aus einem Wasserversorgungs-Leitungsnetz beliefert werden. Das Leitungssystem für die Wasserversorgung wird durch die Hohlschrauben 14a, 14b gebildet, die in das Trennelement eingeschraubt sind und mit Kanälen 15a, 15b in Verbindung stehen, die in dem Trennelement ausgebildet sind und an den Filzstreifen 21 bzw. 31 enden. Die Formen der Kanäle können jedem zweckdienlichen Erfordernis angepaßt werden, beispielsweise gerade, wie bei 15a dargestellt ist, oder abgewinkelt oder gekrümmt, wie bei 15b. Ein Wassertrog 29 unter der gesamten Anordnung nimmt einen eventuellen Wasserüberschuß oder das Tropfwasser auf.

Die Schrauben 14a, 14b haben Außengewinde, und man kann, obwohl das nicht erforderlich ist, Muttern 16a, 16b benutzen, um die Schrauben gegen den Rahmen 11 zu sichern. Die Schrauben 14a, 14b sind mittels einer geeigneten Flüssigkeits-Verschraubung 17a, 17b an eine schematisch dargestellte Druckwasser-Zuleitung angeschlossen, die solche allgemein übliche hydraulische Bauteile, wie Kniestücke, Überwurfmuttern und ähnl. sowie die Ventile 18a, 18b enthält. Das Wasser kann selektiv zu den jeweiligen Filzstreifen 21, 31 geleitet werden. Die Filzstreifen 21, 31 werden auf dem Trennelement 2 mit Hilfe der Halteplatten 22, 32, die die Filzstreifen 21, 31 von beiden Seiten umfassen, in ihrer Lage gehalten; in der Abb. 2 ist nur eine der Halteplatten 22, 32 sichtbar.

Die Rakeln 23, 33 stehen selektiv mit der Oberfläche der Aniloxwalze in Berührung, und sie verlaufen axial, d.i. senkrecht zur Zeichenebene der

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Abb.2. Sie sind am Farbkasten befestigt. Um das selektive Anstellen der Rakeln 23, 33 in Abhängigkeit von der Walzendrehrichtung zu ermöglichen, kann der Farbkasten um den Gelenkzapfen 11b pendeln. Die Rakeln können axial in die Silikongummi-Hinterfütterung 5 eingedrückt sein, die sich leicht zusammendrücken läßt und sich um die Rakel vorwölbt, wie das schematisch bei 23, 24 gezeigt wird, wodurch eine gute Abdichtung gegen diese erzielt wird. Der Teflonstreifen 3 wird vorzugsweise mit scharfen Ecken ausgeführt.

Der Teflonstreifen 3 und die Silikon-Hinterfütterung 5 können in die Ausnehmung 13 eingesetzt werden, indem man sie, beispielsweise mit einem Kontakt-Kleber, darin einklebt.

Der Wasserkanal durch die Schrauben 14a, 14b und die Verbindungskanäle 15a, 15b durch das Trennelement 2 können ganz eng sein, beispielsweise etwa zwei bis drei Millimeter im Durchmesser, gerade genug, um Wasser auf die Filzkissen 21, 31 zu träufeln, so daß sich unter dem Teflonstreifen 3 ein Flüssigkeitsfilm ausbilden kann, der die benachbarten Zonen 10a, 10b ... und die entsprechenden Zonen auf der Aniloxwalze voneinander trennt. Die Bogenlänge der Filzstreifen kann bei einer Walze von etwa 28 cm Durchmesser ungefähr 7 bis 8 cm betragen.

Das Einbringen eines dünnen Wasserfilms zwischen den Teflonstreifen 3 und die Oberfläche der Aniloxwalze 10 hat den Vorteil, daß der Trennstreifen nicht die Aniloxwalze beschädigen kann, und daß eine Dichtung mit einer verlängerten Lebensdauer erzielt wird, die überdies nicht von der hohen Drehzahl der Aniloxwalze 10 beeinträchtigt wird. Die Verwendung von Wasser als Filmflüssigkeit hat einen zusätzlichen Vorteil, weil es das Austrocknen der flexographischen Druckfarbe auf der Aniloxwalze im Bereich der Druckfarbentrennebene verhindert und somit die schmirgelnden Eigenschaften der Druckfarben auf Wasserbasis eliminiert, die anderweitig den Verschleiß des Dichtungswerkstoffs durch das Ansetzen trockener Druckfarbe auf der Aniloxwalze verursachen würde.

Die Größe und Richtung des anzuwendenden Wasserstroms können leicht durch Bedienen des Dreiwegeventils 18 im Wasserzuleitungssystem zu den Kanälen 15a, 15b gesteuert werden. Die Menge kann leicht durch den Versuch ermittelt werden; es sollte gerade so viel Wasser benutzt werden, daß der Farbentrennbereich nicht austrocknet oder auf der Aniloxwalze hart wird. Neben der Wechselwirkung des Wasserfilms mit der Druckfarbe wirkt das Wasser noch zusätzlich als ein Schmiermttel, und es bildet einen Flüssigkeitsfilm auf dem Umfang der Aniloxwalze aus. Folglich schwimmt der Teflonstreifen 3 auf dem Film, und selbst wenn der Anpreßdruck beträchtlich ist, stellt sich ein Effekt ein, der dem Aquaplaning rollender Autoreifen auf einer nassen Straßenoberfläche ähnelt. Dieser Flüssigkeitsfilm beseitigt wirksam die Reibung und verlängert die Lebensdauer der Dichtung. Genau wie beim Aquaplaning der Autoreifen auf der Fahrbahn ist die Reibung sehr gering.

Die Farbwanderung quer durch die Trennebene wird wirksam unterbunden, weil der Flüssigkeitsfilm der Flüssigkeit das Verbleiben nur zwischen der Aniloxwalze und der Teflondichtung gestattet und andererseits das Eindringen von Druckfarbe zwischen die Teflondichtung und die Aniloxwalze verhindert. Somit wird die Wanderung von Druckfarbe mit einer bestimmten Eigenschaft, beispielsweise einer bestimmten Farbe, in die Druckfarbe mit einer anderen Eigenschaft, beispielsweise einer anderen Farbe, wirksam verhindert.

Die Benutzung einer eigenen Gummi-Hinterfütterung 5 ist nicht unbedingt notwendig, aber vorzuziehen. Sie kann leicht erneuert werden und sorgt für einen gleichmäßigen Dichtungsdruck. Ein Silikongummi mit geringer Härte, beispielsweise ein geschlossenzelliger Silikongummi mit dem Härtegrad (Durometer) 30, hinter dem Teflondichtstreifen angeordnet, sorgt für eine gleichbleibende, gleichmäßige Dichtpressung gegen die Fläche der Aniloxwalze. Der Silikongummi mit geringer Härte zwischen der Wand des Trennelements 2 und der Teflondichtung sorgt auch für eine wirksame Abdichtung an den Ecken der Rakeln. Diese Silikongummiart erlaubt eine Komprimierung um etwa 20 %, was die Ursache für die leichte Ausdehnung 24, 25 des Silikongummis um die Rakelenden und Rakelecken ist.

Für die Herstellung der den Wasserfilm erzeugenden Elemente 21, 31 können verschiedene Werkstoffe verwendet werden; Filz ist besonders geeignet, weil er ein dosiertes Aufträufeln oder Auftragen des Wassers unter den Trennstreifen 3 ermöglicht. Das Wasser kommt mit den oberhalb und unterhalb der Teflondichtung angeordneten Filzkissen 21, 31 in Berührung. Die Dichte des Filzes ist solcherart, daß eine gleichmäßige Verteilung des Wassers erreicht wird. Das Wasser sickert infolge der Schwerkraft in den unteren Teil der Filzkissen.

Diese Anordnung hat den zusätzlichen Vorteil, billig zu sein. Teflon ist wesentlich teurer als Silikongummi oder Filz, und durch die Verwendung eines dünnen, kleinen Teflonstreifens mit rückseitiger Hinterfütterung mit Silikongummi und mit Filzkissen zu beiden Seiten verringert sich die benötigte Teflonmenge. Das Teflon wird nur in den Bereichen des Farbkastens zwischen der oberen und der unteren Rakel gebraucht.

Gemäß einer vorteilhaften Ausgestaltung der Erfindung kann der ganze Farbkasten 11 zusammen mit dem Trennelement 2, dem Streifenelement 3, mit dessen Hinterfütterungselement 5 und

mit den Rakeln 23, 33 um den Zapfen 11b pendeln. Der Kasten 11 wird am Maschinenrahmen von der Konsole 40 gehalten, die mit einer Haltestange 41 gekuppelt ist, die um den Gelenkzapfen 11b pendeln kann, wie das durch den Pfeil 42 in Abb. 2 schematisch dargestellt ist. Die Haltestange 41 ist abgebrochen dargestellt, weil der Gelenkzapfen 11b - bezogen auf die Abb. 2 - in der Regel weiter links liegt, und er auf der Zeichnung normalerweise nicht sichtbar sein würde, weil er beispielsweise hinter dem Ventil 18 versteckt wäre. Die Lage in der Abb. 2 ist nur aus Gründen der klaren Darstellung gewählt worden. Der Farbkasten 11 ist üblicherweise trogförmig, um den Hohlraum 11a für die Druckfarbe zu bilden. Die Druckfarbe wird kontinuierlich durch Eintrittsöffnungen 45 in den Farbhohlraum 11a eingeleitet und an den Austrittsöffnungen 46 abgelassen, wobei die Druckfarbe im Farbhohlraum ständig in Umlauf gehalten wird. Die Aniloxwalze 10, welche die Rakeln 23, 33 berührt oder in einem ganz kleinen Abstand von ihnen steht, verhindert den Verlust von Druckfarbe.

Gemäß einer weiteren vorteilhaften Ausgestaltung der Erfindung kann der Farbkasten 11 in Bezug auf die Aniloxwalze 10 wegbewegt werden, so daß die beiden Rakeln 23, 33 den Kontakt mit der Aniloxwalze 10 verlieren. Die Bewegung ist ganz gering, ein Bruchteil von einem Millimeter. Dadurch wird die ständige Umwälzung der Flexodruckfarbe im Farbtrog 11a sowie die Rotation der Aniloxwalze 10 mit niedriger oder mit Leerlaufdrehzahl ermöglicht, wodurch das Antrocknen der Farbe an der Walze 10 während der Zeiten, in denen nicht gedruckt wird, vermieden und dabei die Trennung der verschiedenen Druckfarben, beispielsweise in den verschiedenen Zonen 10a, 10b, aufrechterhalten wird. Das Streifenelement 3 sowie die Kissen 21, 31 dehnen sich etwas aus - nachdem sie vorher zusammengedrückt gewesen waren - aber nicht so sehr, daß sie den Kontakt mit der Aniloxwalze verlieren würden. Wenn eines der Kissen 21, 31 oder beide Kissen über einem Teil des Umfangs den Kontakt verlieren sollten, so kann das wenig Schaden anrichten. Es wird genügend Wasser nachgeliefert, um einen ringförmigen Flüssigkeitsfilm entlang dem Streifen 3 auf der Aniloxwalze 10 zu bilden, so daß der Streifen 3 auf dem ringförmigen Film schwimmen oder gleiten und dadurch dauernd verhindern kann, daß die Farben aus den Zonen 10a, 10b sich vermengen oder ineinander verlaufen, während die Aniloxwalze sich immer noch weiterdrehen darf, wobei sie vor dem Farbenhohlraum 11a verbleibt. Die Bewegung des Farbtroges in der Weise, daß die Rakeln 23, 33 von der Walze 10 freikommen, d.h. gerade eben freikommen, wobei es dem Hinterfütterungsgummi 5 sowie auch den Kissen 21, 31 möglich ist, sich auszudehnen, kann auf jede geeignete Art und Weise erreicht werden. Wie in der Abb. 1 dargestellt ist, verläuft die gemeinsame Achse 50 längsseits des Farbwerks, parallel zum Farbtrog 11. Sie kann pendeln, wie durch den Pfeil 51 angedeutet wird. Die Achse 50 ist mit Hilfe eines Winkelhebels 52 mit der Tragstange 41 bzw. der Konzole 40 der Kippeinrichtung des Trennelements 2 gekoppelt.

Wirkungsweise:

Wenn die Aniloxwalze 10 im Uhrzeigersinn, in Vorwärtsdrehung, läuft, sollte das obere Kissen entfernt und das obere Tropfsystem abgestellt werden, indem man z.B. das Ventil 18 so stellt, daß das Wasser zum unteren Kissen 31 geleitet wird. Das untere Kissen 31 verbleibt an seinem Platz, und das untere Tropf-oder Wasserauftragsystem wird durch das Ventil 18 in Betrieb gesetzt, und durch diese Aktion trägt das Kissen 31 einen dünnen Wasserfilm auf die Walze 10 auf, der es dem Streifen 3 ermöglicht, auf dem Film zu - schwimmen. Nach dem Anlaufen der Walze 10 bildet sich auf der Walze 10 ein Wasserring aus, der die benachbarten Druckfarbenzonen voneinander trennt. Der Farbkasten 11 wird um die Achse 11b geschwenkt, siehe Pfeil 42, um die Rakel 23 außer Eingriff zu bringen. Die Gummi-Hinterfütterung 5 vergleichmäßigt den Berührungsdruck des Streifens 3 gegen die Walze 10. Nach dem Umsteuern der Drehrichtung der Aniloxwalze 10 in die Richtung entgegen dem Uhrzeiger kann das untere Tropfsystem durch Verändern der Stellung des Ventils 18 abgestellt und das untere Filzkissen 31 entfernt werden. Das obere Filzkissen 21 bleibt an seinem Platz, und das obere Tropfsystem wird eingeschaltet. Das nicht benetzte Kissen sollte entfernt werden, damit es nicht austrocknet. Das Entfernen des Filzkissens ist einfach, man braucht es nur herauszuziehen, auch kann man die Befestigungsschrauben lösen, die die betreffende Klemmplatte 22, 32 halten, und dann die jeweiligen Filzstreifen 21, 31 herausnehmen.

Unter normalen Druckbedingungen kann die Walze 10 z.B. mit Drehzahlen von mehr als 800 U/min laufen. Wenn die Maschine nicht druckt, war es üblich, den Farbenzufluß abzustellen und einen "Reinigungsvorgang" einzuschalten, um das Antrocknen der sich schnell verflüchtigenden Farbe auf der Aniloxwalze 10 und im Farbkasten zu verhindern. Gemäß dem Merkmal der vorliegenden Erfindung kann jedoch die Walze 10 im Leerlauf weiterlaufen gelassen werden, z.B. bei 30 U/min, wobei die Farbe kontinuierlich zwischen den Eintrittsöffnungen 45 und den Austrittsöffnungen 46 - in Abb. 1 nur in verschiedenen Farbzonen dargestellt - umgewälzt wird, während die Farbzonen voneinander getrennt bleiben. Nach dem Kippen

der Welle 50 entgegen dem Uhrzeigersinn des Pfeils 51 kommen beide Rakeln 23 und 33 außer Eingriff mit der Aniloxwalze 10. Die Kippachse der Welle 50 ist vorzugsweise im wesentlichen vertikal mit der Drehachse der Aniloxwalze 10 ausgerichtet, und, beispielsweise, etwas unterhalb des Farbtrogs 29. Die normale Zusammenpressung des Gummi-Hinterfütterungselements 5 kann beim Drucken etwa 20 % seiner ungespannten Nenndicke betragen, die der Filzkissen etwa 10 %. Ein leichtes Ankippen des Farbkastens 11 erlaubt eine gewisse Entspannung der Gummi-Hinterfütterung 5 und der Filzkissen 21, 31, jedoch ohne daß diese ihrer Funktion verlustig gehen würden. Auf diese Weise kann der Reinigungsvorgang während der Leerlaufperioden eliminiert werden. Die Streifenelemente 3 und die Kissen 21, 31 bleiben mit der Walze 10 in Berührung, und sie trennen so die Farbzonen, wobei sie die Kanten der Rakeln 23, 33 und die Oberfläche der Aniloxwalze schützen.

Innerhalb des Umfangs des Erfindungskonzepts können vielfältige Änderungen und Modifikationen vorgenommen werden.

Ansprüche

1. In einer Flexodruckmaschine

eine Anordnung zum Aufteilen eines Farbkastens (11) in verschiedene axiale Zonen (10a, 10b), um die Verwendung von Druckfarben mit jeweils unterschiedlichen Eigenschaften in verschiedenen Zonen einer Aniloxwalze (10) zu ermöglichen,

erfindungsgemäß beinhaltend

ein trennendes Streifenelement (3) mit einer gekrümmten Oberfläche, das an der Oberfläche der Aniloxwalze (10) anliegt und mit dieser zusammenpaßt, und das sich über einen Teil des Umfangs derselben erstreckt;

sowie Mittel (21, 14a, 15a; 31, 14b, 15b; 18) zum Einbringen eines hydraulischen Films einer Trennflüssigkeit zwischen die Oberfläche des Streifenelements (3) und die Oberfläche der Aniloxwalze (10) als Flüssigkeitsring im wesentlichen nur in jener Umfangsregion der Aniloxwalze, die den besagten Teil deren Umfang einschließt.

2. Die Anordnung nach Anspruch 1, in welcher die besagte Flüssigkeit Wasser enthält.

3. Die Anordnung nach Anspruch 1, in welcher die besagten Mittel zum Einbringen eines hydraulischen Films der Trennflüssigkeit ein Kissenelement (21, 31) aus einer porösen Substanz beinhalten, das fluchtend mit dem besagten Trennstreifenelement (3) angeordnet ist; und

Mittel einer Flüssigkeits-Versorgungsleitung (14a, 15a; 14b, 15b) in Flüssigkeitsverbindung mit dem besagten Kissenelement (21, 31) aus einer porösen Substanz.

4. Eine Anordnung nach Anspruch 3, in welcher zwei Kissenelemente (21, 31) und zwei Mittel für eine Flüssigkeits-Versorgungsleitung vorgesehen sind, wobei die jeweiligen Kissenelemente angrenzend an die äußersten Enden des besagten Trennstreifenelements (3) angeordnet sind.

5. Eine Anordnung nach Anspruch 3, in welcher die besagten Kissenelemente aus einer porösen Substanz Filzkissen einschließen.

6. Eine Anordnung nach Anspruch 1, weiterhin beinhaltend ein Hinterfütterungselement (5), das angrenzend an das Trennstreifenelement (3) an dessen von der besagten Aniloxwalze (10) abgewandten Seite angeordnet ist, wobei das besagte Hinterfütterungselement ein zusammendrückbares Material einschließt.

7. Eine Anordnung nach Anspruch 6, in welcher das besagte zusammendrückbare Material Silikongummi einschließt.

8. Eine Anordnung nach Anspruch 6, weiterhin beinhaltend ein Trennelement (2), das eine Halterungsstruktur definiert, welche besagte Halterungsstruktur mit einer Ausnehmung (13) ausgeführt ist, die sich über einen Umfangsteil der besagten Aniloxwalze erstreckt, und wobei das besagte Hinterfütterungselement (5) in der besagten Ausnehmung gehalten wird;

und beinhaltend einstellbare Mittel (12), die mit dem Trennelement einstellbar im Eingriff stehen, um eine im wesentlichen radial gerichtete Kraft auf das besagte Hinterfütterungselement auszuüben und das Trennelement (3) gegen die Oberfläche der Aniloxwalze (10) anzudrücken.

9. Eine Anordnung nach Anspruch 6, weiterhin beinhaltend Rakelmittel (23, 33), die eine axiale Länge aufweisen, die sich bis zum Trennelement erstreckt, welche besagten Rakelmittel (23, 33) mit einer Kantenpartie mit dem besagten Hinterfütterungselement(5) aus zusammendrückbarem Material in Berührung steht, um es dem zusammendrückbaren Material zu ermöglichen, sich gegen die Rakelmittel auszubauchen und die Kante der Rakelmittel abzudichten.

10. Eine Anordnung nach Anspruch 1, weiterhin beinhaltend ein Trennelement (2), das eine Halterungsstruktur definiert;

elastische Hinterfütterungsmittel (5) zum elastischen Unterstützen des besagten Streifenelements (3) an der Halterungsstruktur für eine in dem Teil des Umfangs in hohem Maße gleichmäßige elastische Berührung des Streifenelements mit der Aniloxwalze (10);

Rakelmittel (23, 33), angeordnet am Farbkasten (11) und

Mittel (41, 42; 50, 51, 52), welche den Farbkasten beweglich abstützen, zum Zweck des selektiven Eingriffs der Rakelmittel an der Aniloxwalze oder des Abhebens der Rakelmittel um einen

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kleinen Abstand, der ausreicht, um die Rakelmittel von der Aniloxwalze freizubekommen, während die elastische Berührung des Streifenelements (3) mit der Aniloxwalze (10) beibehalten und das Aufbringen der Trennflüssigkeit auf die Aniloxwalze mit den besagten Flüssigkeits-Anwendungsmitteln fortgesetzt wird.

11. Eine Anordnung nach Anspruch 10, in welcher die besagten Mittel zum Aufbringen des hydraulischen Trennflüssigkeitsfilms zwei dochtartige Kissenelemente (21, 31) aus einer porösen Substanz beinhalten, die fluchtend mit dem besagten Streifenelement (3) an den äußersten Enden des Streifenelements angeordnet sind;

in welcher zwei Rakeln vorgesehen sind, die die besagten Rakelmittel bilden, wobei eine erste Rakel (23) der Aniloxwalze in der einen Drehrichtung und eine zweite Rakel (33) der Aniloxwalze in der umgekehrten Drehrichtung zugeordnet ist;

und in welcher Anordnung die beweglichen Stützmittel den selektiven Angriff an der Aniloxwalze

(a) der ersten Rakel,

(b) der zweiten Rakel, und

(c) keiner der Rakeln

ermöglicht, während die Aniloxwalze (10) mit mindestens einem der besagten Kissenelemente (21, 31) in der Position der Flüssigkeitsübertragung verbleibt.

12. In einer Flexodruckmaschine ein Farbkasten (11), beinhaltend eine Anordnung zum Aufteilen des Farbkastens in verschiedene axiale Zonen (10a, 10b, ...), um die Farbe auf eine Aniloxwalze (10) in verschiedenen axialen Zonen auftragen zu können und die Verwendung von Druckfarben mit jeweils unterschiedlichen Eigenschaften, z.B. in verschiedenen Farben, in den verschiedenen Zonen zu ermöglichen,

erfindungsgemäß beinhaltend

ein Trennelement (2) mit einer Fläche, die an der Aniloxwalze (10) anliegt und sich über einen Teil des Umfangs derselben erstreckt;

ein Trennstreifenelement (3) mit einer gekrümmten Fläche aus reibungsarmem Material, die gegen die Oberfläche der Aniloxwalze anliegt und an diese angepaßt ist;

ein Hinterfütterungsmittel (5) aus zusammendrückbarem Material, befestigt an dem besagten Trennelement und das besagte Trennstreifenelement (3) in seiner Lage haltend und sich über einen Teil der Umfangslänge des besagten Trennelements (2) erstreckend;

ein Kissenelement (21, 31) aus einer flüssigkeitsdurchlässigen und porösen Substanz, gehalten von dem besagten Trennelement (2), angrenzend an die Endteile des Trennstreifenelements (3) und sich von den Endteilen des Trennstreifenelements weg erstreckend;

Mittel für die Flüssigkeitszufuhr (14a, 15a; 14b, 15b; 18), die eine Trennflüssigkeitsquelle mit dem besagten Kissenelement verbinden, um eine Trennflüssigkeit zu demselben zu fördern und infolgedessen auf der Oberfläche der Aniloxwalze (10) und zwischen der Oberfläche der Aniloxwalze (10) und dem Trennstreifenelement (3) einen Trennflüssigkeitsfilm ausbilden zu können;

und Mittel (12, 41, 42; 50, 51, 52) zum Anstellen des Trennelements (2) an die Oberfläche der Aniloxwalze (10).

13. Die Anordnung nach Anspruch 12, in welcher das besagte Trennstreifenelement Teflon einschließt, das besagte Hinterfütterungselement (5) Silikongummi einschließt und das besagte Kissenelement ein Filzkissen einschließt.

14. Die Anordnung nach Anspruch 12, in welcher das besagte Trennelement (2) eine Halterungsstruktur definiert;

zwei Kissenelemente vorgesehen sind, je eines an den äußersten Enden des Trennstreifenelements;

zwei Rakeln vorgesehen sind, eine erste Rakel (23), die der einen Drehrichtung der Aniloxwalze (10) zugeordnet ist und eine zweite Rakel (33), die der umgekehrten Drehrichtung der Aniloxwalze zugeordnet ist,

wobei die besagten Rakeln an dem besagten Farbkasten befestigt sind;

und in welcher Anordnung die Anstellmittel zum Anstellen des Trennelements gegen die Oberfläche der Aniloxwalze Mittel (41, 42; 50, 51, 52) beinhalten für die bewegliche Abstützung des Farbkastens zum Zweck des selektiven Anstellens einer der beiden besagten Rakeln an die Aniloxwalze in Abhängigkeit von der jeweiligen Drehrichtung der Aniloxwalze, oder zum Abheben beider Rakeln von der Oberfläche der Aniloxwalze durch Trennen der Rakelkanten von der Oberfläche der Aniloxwalze um einen kleinen Abstand, um die Aniloxwalze freizugeben, während die elastische Berührung des Streifenelements (3) mit der Aniloxwalze und mindestens eines Kissenelements mit der Aniloxwalze aufrechterhalten bleiben, um kontinuierlich Trennflüssigkeit zu der Aniloxwalze zu leiten und den besagten Trennflüssigkeitsfilm zwischen der Oberfläche der Aniloxwalze und der Oberfläche des Trennstreifenelements bilden zu können.

15. Verfahren zum gegenseitigen Abdichten von Druckfarben mit verschiedenen Eigenschaften in axialen Zonen (10a, 10b, ...) einer Aniloxwalze (10) mit Hilfe eines Trennelements (2, 3), beinhaltend den Schritt

der Einführung eines Umfangsrings eines Trennflüssigkeitsfilms zwischen den besagten Zonen durch Anlegen eines porösen, dochtartigen Kissens gegen die Oberfläche der Aniloxwalze

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(10), sättigen des besagten Kissens mit der besagten Flüssigkeit und Gleiten des besagten Elements auf dem besagten Film.

16. Verfahren gemäß Anspruch 15, bei welchem die besagte Flüssigkeit Wasser einschließt.

17. Verfahren gemäß Anspruch 15, beinhaltend den Schritt, ein separates Streifenelement (3) einzuführen, das eine reibungsarme Oberfläche hat, die nach der Oberfläche der Aniloxwalze (10) gekrümmt und an diese angepaßt ist, und die sich über einen Teil des Umfangs derselben erstreckt;

das besagte Trennstreifenelement elastisch gegen den besagten Ring oder Film aus der Trennflüssigkeit anzulegen, und

worin der besagte Schritt der Einführung des Umfangrings oder -films die Einführung einer gerade ausreichenden Flüssigkeitsmenge einschließt, um ein effektives Gleiten des Trennstreifens auf dem Flüssigkeitsfilm zu erreichen.

18. Verfahren gemäß Anspruch 15 für die Anwendung in einer Flexodruckmaschine, die zwei Rakeln (23, 33) aufweist, die selektiv an die Aniloxwalze (10) anstellbar oder von ihr abhebbar sind,

in welchem der Schritt der Einführung des besagten Flüssigkeitsfilms das Aufrechterhalten des besagten Flüssigkeitsfilms auf der Aniloxwalze und das Fortdauern des Schwimmens des Trennelements auf dem besagten Film einschließt, auch wenn die Rakeln von der Aniloxwalze abgehoben sind.

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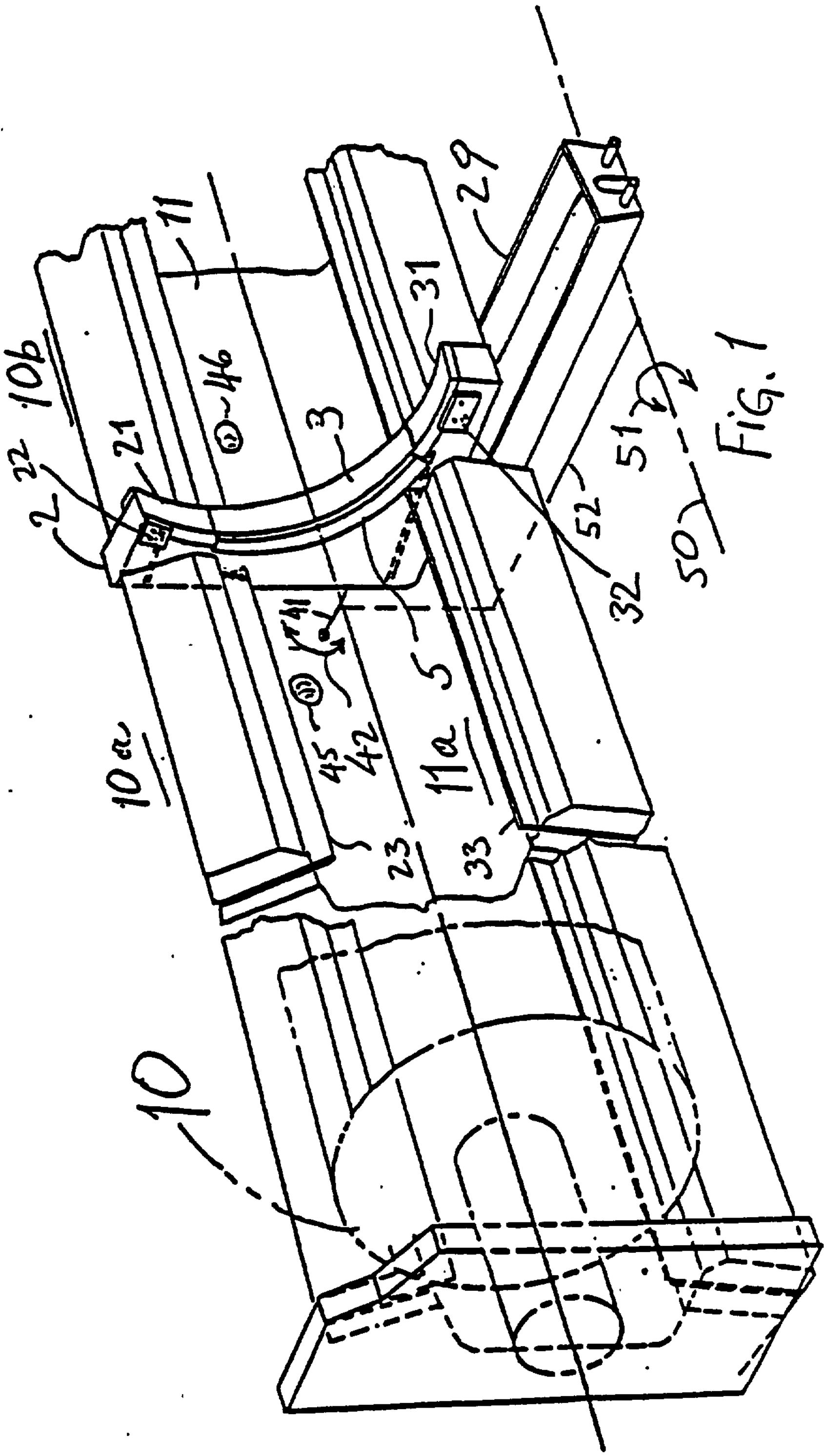

FIG. 1

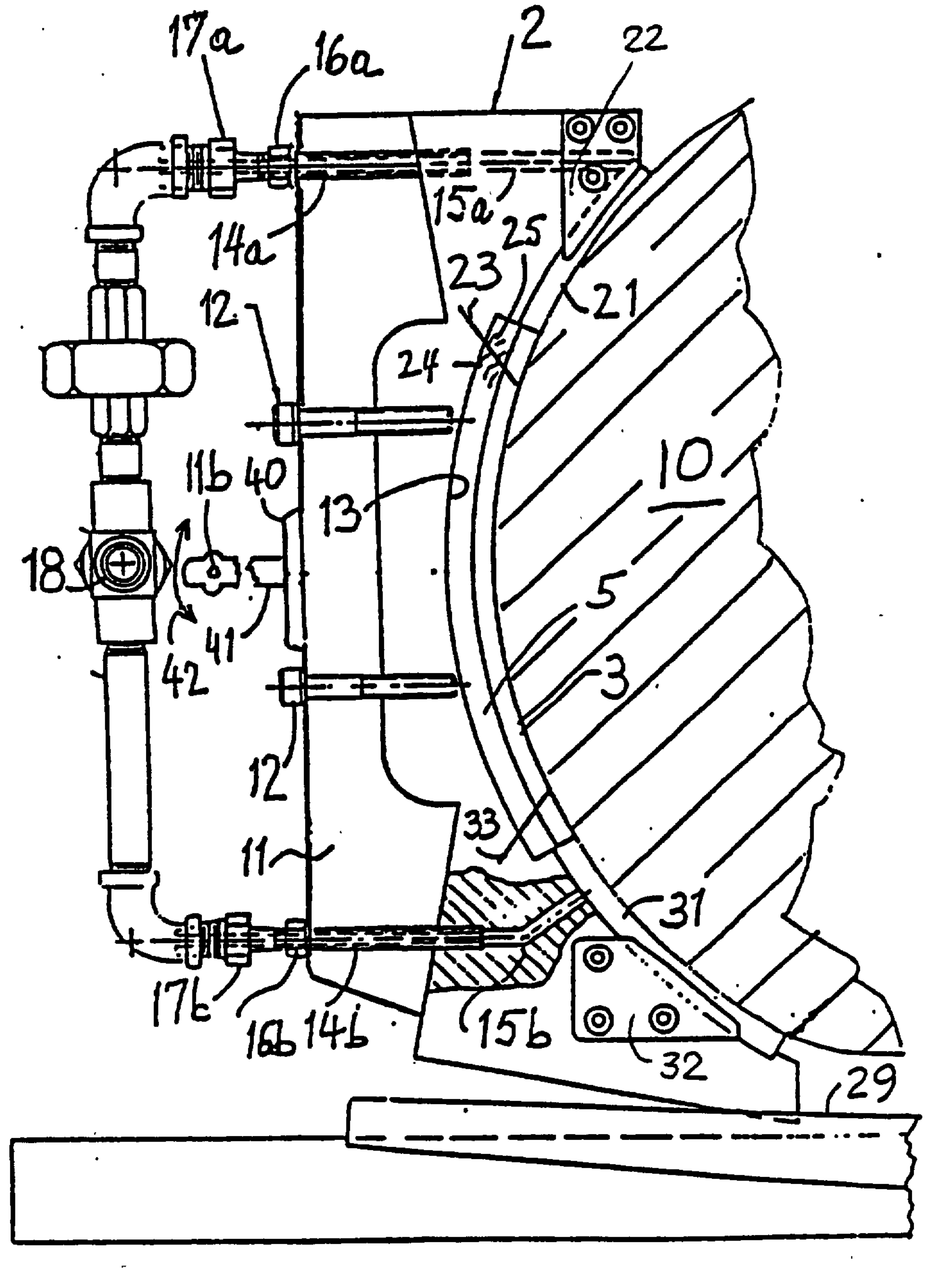
17a
16a
2
22
15a
14a
25
23
21
12
24
10
11b
40
13
18
5
42
41
3
12
33
11
31
17b
16b
14b
15b
32
29

Fig. 2

41

United States Patent [19]

DiRico

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[45] Date of Patent: Aug. 11, 1987

[54] COATING PRINTED SHEETS

[76] Inventor: Mark A. DiRico, 416 Adams St., Quincy, Mass. 02169

[21] Appl. No.: 719,474

[22] Filed: Apr. 3, 1985

[51] Int. Cl.⁴ B05C 1/08; B05C 11/10

[52] U.S. Cl. 118/46; 118/211; 118/262

[58] Field of Search 118/46, 262, 261, 211; 101/352

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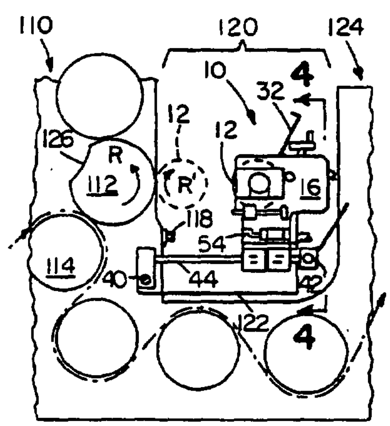
Primary Examiner—Evan K. Lawrence

[57] ABSTRACT

Apparatus for applying a liquid coating to the surface of a sheet workpiece and adapted for operation on-line with the last unit of a lithographic sheet printing press. The apparatus comprises: (1) a textured metering roller in a mount which is linearly movably attached to a support platform fixed adjacent the press unit, and extending between the last press unit and a remote point. The support platform allows movement of the metering roller and the mount between a first position in which the mount is continuously adjustably biased against the last press unit, and a second position, away from the last press unit to allow use of the last press unit as a lithographic press. The platform comprising longitudinal supports arranged generally perpendicular to a vertical plane through the axis of said metering roller, and the metering roller mount is movably supported and guided along the supports.

In the first position, the metering roller continuously delivers a smooth, uniform, metered amount of liquid material to the blanket roller of the printing press. The apparatus also includes a latch that allows the mount, with its attached metering roller, liquid coating supply, and metering roller rotation device, to be readily detached from and moved out of the way of the press unit, so that the press unit can be used as a lithographic press unit. A biasing latch and an adjustable stop allow the metering roller and mount to be readily and reliably returned, locked and biased in the first position.

8 Claims, 4 Drawing Figures



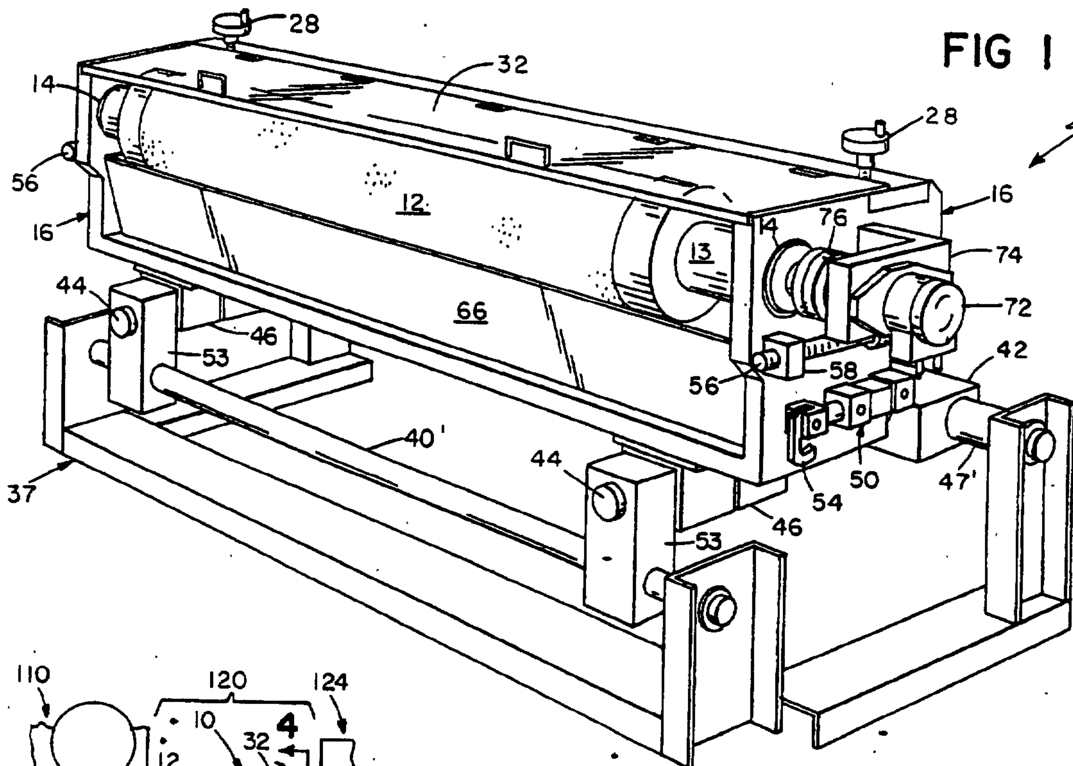


FIG 1

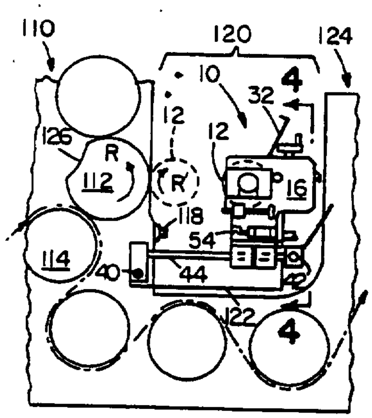


FIG 3

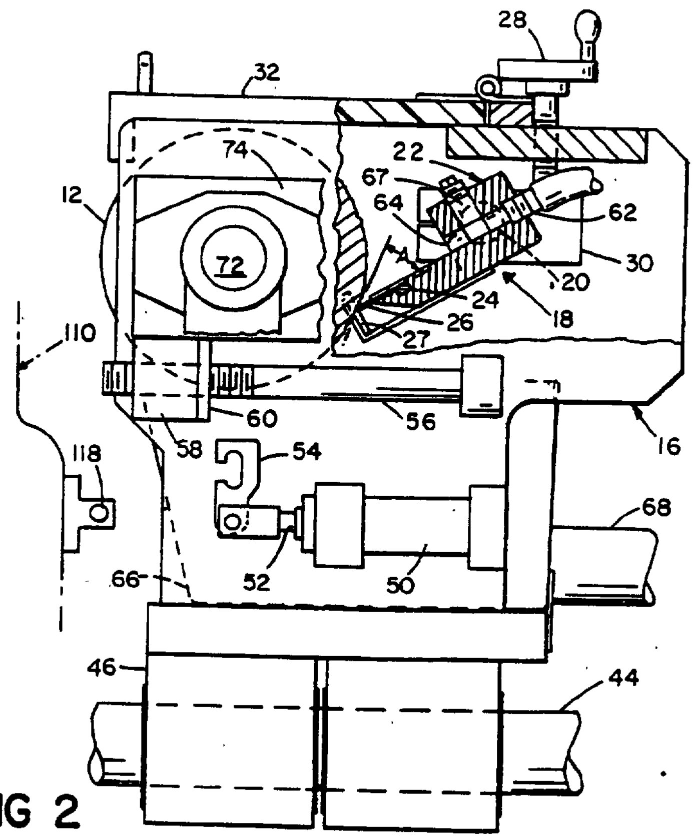


FIG 2

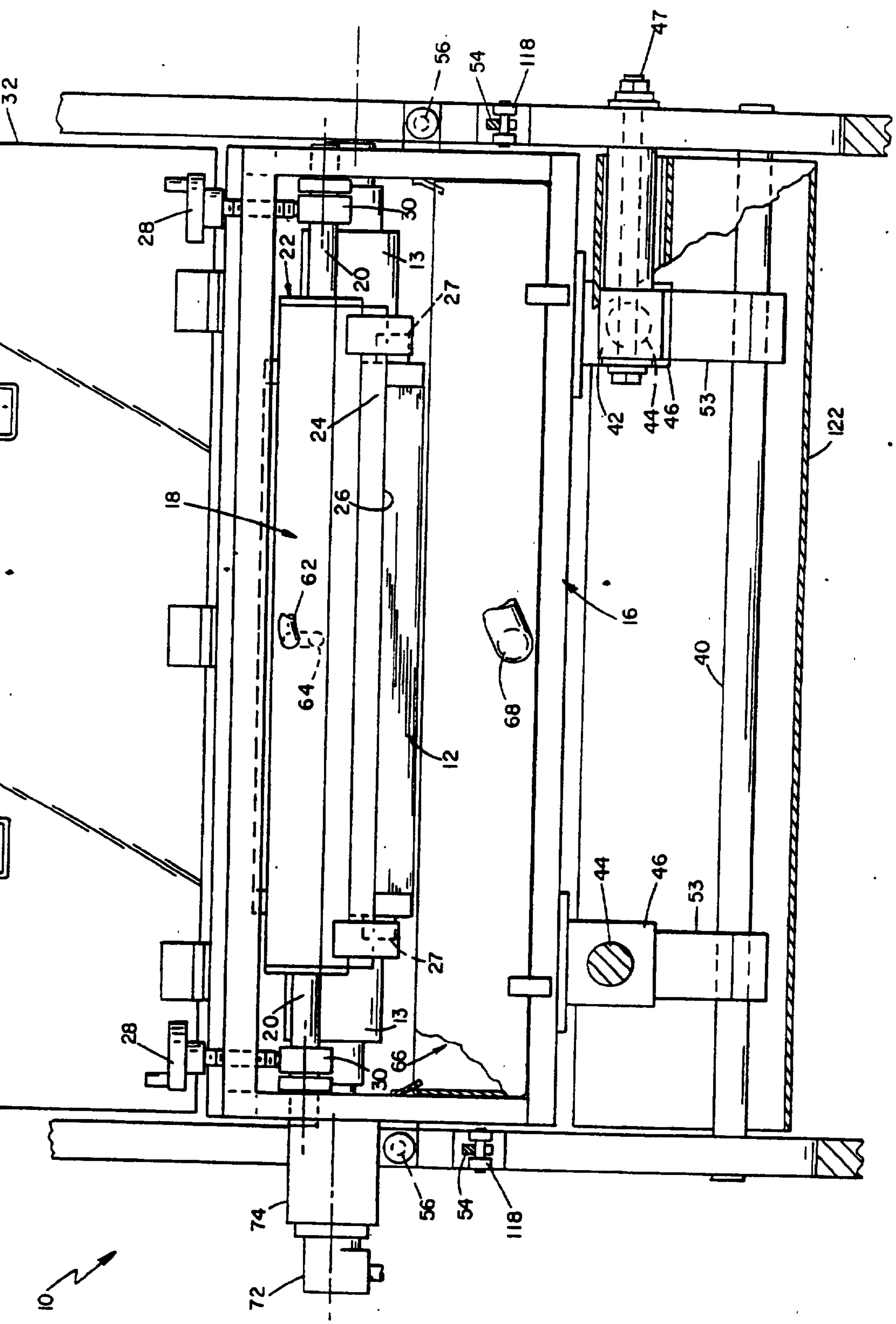

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FIG 4

COATING PRINTED SHEETS

BACKGROUND OF THE INVENTION

This invention relates to coating printed sheets.

In many applications it is desirable to apply a coating to a printed sheet. For example, a water soluble polymer finish may be applied to a workpiece printed by offset lithography to "dry" the sheet quickly by coating the surface while it is still tacky. This coating avoids the need for powder driers that may be cumbersome or air drying procedures that may be slow. Coatings are also useful for providing a glossy finish that improves the rub-resistance of the workpiece and improves its overall appearance. Finally, adhesive coatings may be applied to printed packaging; for example, heat-set adhesives may be applied to enable attachment of a feature such as the clear plastic bubble of a package used to display the product.

Application of coatings to a workpiece is made difficult by various requirements. For example, the coating should be uniform and its thickness should be controlled. Moreover, the coating should be applied quickly, before its vehicle evaporates causing it to thicken. Finally, it is desirable for the coater to operate "on-line" with the press that prints the workpiece to take full advantage of the fast-drying capability of coatings and generally to simplify the manufacture of printed coated workpieces.

Butler U.S. Pat. No. 4,270,483 discloses an on-line coating apparatus for attachment to a conventional offset lithographic printing press. The apparatus includes a set of rollers (i.e. pick-up roller 14 and application roller 16) to deliver coating material from a reservoir 18 to a blanket roll 108. A metering rod 40 meters the amount of coating transferred to application roller 16.

An on-line coater sold by Norton Burdett Co. of Nashua, N.H. has a single roller driven directly by a D.C. motor. The roller is a gravure cylinder that transfers coating to a blanket cylinder. The coater is attached to a pivoting arm, and the unit can be pivoted away from the press unit when the coater is not in use.

Another on-line coater, sold by IVT Colordry, Inc. of Fairfield, Conn., applies coating from a reservoir pan to a blanket cylinder using a pick-up roller that delivers a metered coating supply to an applicator roller; the applicator roller applies the coating to the blanket cylinder of a press unit.

Kumpf U.S. Pat. No. 3,768,438 discloses a coater in which a fountain roller dips into a coating reservoir and transfers liquid coating material to a feed roller. The feed roller in turn transfers coating material to a coating roller that coats a sheet fed between the coating roller and a format roller.

SUMMARY OF THE INVENTION

The invention generally features apparatus to be mounted on-line with a printing press unit for coating the surface of a sheet workpiece with liquid material. The coating apparatus comprises a textured (e.g., engraved) metering roller or cylinder rotably mounted to be forced against the blanket roller of the press unit. A doctor assembly comprising an elongated blade edge is positioned against the engraved roller surface, and includes means to deliver the liquid material to the longitudinal engraved surface of the roller. The engraved metering roller delivers a metered amount of the liquid to the blanket roller, which transfers the liquid material to the sheet workpiece.

Preferred embodiments of the apparatus include the following features. A hydraulic cylinder mounted on the coating apparatus pulls a piston rod that is clamped to the press unit, thus forcing the metering roller against the blanket roller. The printing press is an offset lithographic press having an indented region on the blanket roller surface, and the mounting means includes a stop to limit movement of the metering roller toward that indented region. The mounting means is movably attached to a platform so the coating apparatus is moveable away from the printing press unit when the coating apparatus is not in use. Specifically, the mounting means has bearings that slide along longitudinal support rails arranged to be generally perpendicular to a vertical plane through the metering roll axis. The doctor assembly includes means to deliver liquid coating from a liquid coating reservoir to an outlet positioned to deliver coating liquid to a central portion of the engraved surface adjacent the doctor blade; the outlet is positioned so that as the metering roll rotates, coating delivered from the outlet encounters the doctor blade before it encounters the blanket roller. The position of the doctor blade can be adjusted relative to the metering roll surface. A drip pan positioned below the doctor blade has an outlet to drain and recirculate coating material that flows from the ends of the metering roller and doctor assembly. A hydraulic motor is mounted to drive the metering roller directly, rotating it in a predetermined rotational direction.

The apparatus provides a compact, versatile and reliable means for coating printed sheets. Specifically, the apparatus can be added to an existing press unit without significant modification to the unit; and once added, the apparatus can be moved out of the way so that the press unit to which it is attached can be used for printing. This is particularly useful when the number of colors to be printed requires the use of the press unit to which the coater is attached.

The apparatus is capable of delivering a metered amount of coating to the blanket roller without the use of bulky complex metering systems and without serious clogging of the coating flow path. Versatility is achieved by using the blanket roller of an existing press unit, yet the apparatus can be detached easily from the press unit and moved out of the way. At the same time, when it is in use, the apparatus is stable and provides a steady even pressure against the blanket roller, notwithstanding the considerable range of forces and vibrations to which the metering roller is subject. The apparatus accommodates indentations in the blanket roller without suffering uneven compressive forces that could "squeeze" liquid coating from the blanket and cause streaking. Finally, the use of the hydraulic assist motor with a direct drive enables a smooth start up, delivering an even amount of coating to the blanket roller quickly after start-up without streaking that can be experienced with other drive systems.

Other features and advantages of the invention will be apparent from the following description of the preferred embodiment and from the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a coating apparatus supported independently and not attached to a press unit.

FIG. 2 is a side view of the coater of FIG. 1, with parts broken away and in section, including a portion of an adjacent press unit.

FIG. 3 is a highly schematic representation of the coater of FIG. 1 attached to a press unit.

FIG. 4 is a rear view of the coater of FIG. 1 with parts broken away and in section.

APPARATUS

FIG. 1 shows coating unit 10 separated from a press, as it would be in storage or in construction. As shown in FIGS. 2 and 3, coating unit 10 is adapted to attach to the most downstream unit 110 of a standard multi-unit offset lithograph press. Coating unit 10 has a single engraved roller 12 and shaft 13 rotably mounted on bearings 14 that are attached to a housing 16. When the coating unit is attached to press unit 110, the axis of roller 12 is parallel and horizontally aligned with the axis of blanket roller 112, and roller 12 contacts the blanket roller 112 so that roller 12 delivers liquid coating to blanket roller 112.

As shown best in FIG. 2, a doctor blade assembly 18 is adjustably mounted in housing 16 to deliver liquid coating to engraved roller 12 and to spread a metered level of the coating along the roller surface. Assembly 18 includes a rotably mounted axle 20 spanning housing 16 parallel to the longitudinal axis of roller 12. Mounted centrally on axle 20 is a rectangular housing 22 from which a blade clamp 24 extends. Doctor blade 26 is fixed in clamp 24 and is held against roller 12 at an angle. Blade 26 is blue spring steel about 0.007 inches thick, and it extends from clamp 24 about ½ inch. The set-up angle A (FIG. 2) is about 30°. Blade 26 is forced against roller 12 at a pressure of e.g. 25–30 pounds for a 60-inch blade (i.e. about 0.5 pounds per inch).

In FIG. 2, doctor blade assembly 18 also includes a fitting 62 communicating with a passage through doctor blade housing 22 to outlet 64. A plugged passage 67 in housing 22 allows access to the interior of the housing for cleaning. A drip pan 66 having an outlet 68 is positioned below roller 12 and doctor blade assembly 18.

Adjustment of blade 26 to roller 12 is achieved by two adjustment screws 28 which extend through the top of housing 16 at opposite ends thereof. Screws 28 extend to adjustment brackets 30 on axle 20. Because screws 28 are attached to brackets 30 at points off of the center of the axle 20, rotation of screws 28 will pivot axle 20 and brackets 30, changing the pressure between blade 26 and roller 12. Wipers 27 on assembly 18 at each end of roller 12 prevent liquid coating from building up on the ends of the roller 12.

Unit 10 also includes a clear cover 32 hinged to the top of housing 16 to protect roller 12.

As shown in FIGS. 3 and 4, housing 16 is movably mounted above the floor 122 of the well 120 between press unit 110 and downstream unit 124, which is, e.g., a rack for storing bundles of the finished workpieces. Specifically, housing 16 is mounted on bearing blocks 46 that slide on two parallel tie rods or rails 44 oriented perpendicular to the axis of roller 12. Rails 44 are supported at one end by blocks 53 that are adjustably mounted on cross shaft 40 of press unit 110. At their other ends, rails 44 are supported respectively by blocks 42 on shafts 47 fixed to press unit 110. As best shown in FIG. 3, shaft 40 and shafts 47 are integrated with the floor 122 of well 120. Shaft 40 is an existing shaft on unit 110. Shafts 47 are added to the unit to accommodate coater 10. (In FIG. 1, the coater 10 is shown separate from unit 110, as it might be stored or transported; rails 44 are supported by a frame 37 of metal beams that support shaft 40' and shafts 47').

Hydraulic cylinders 50 (one shown) are mounted on opposite sides of housing 16 to drive piston arms 52 and maintain proper pressure between roller 12 and roller 112. At one end of each piston arm 52 is a latch 54 that cooperates with a lug 118 on unit 110 to latch the coating unit to the press. Also fixed to each side of housing 16 is an adjustable stop screw 56 that is threaded through a block 58 and locked in place with lock nut 60. Cylinders 50 are connected to limit switches (not shown) to release the pressure between rollers 12 and 112 when the press is off impression.

On one side of housing 16 a hydraulic motor 72 is mounted to motor support 74 to drive roller 12 directly via coupling 76.

OPERATION

The coater is first locked into operation on press unit 110 by manually moving it along rails 44 toward unit 110 and rotating latch 54 to engage a lug on unit 110. In operation, when the press is off impression, hydraulic motor 72 rotates roller 12 as coating fluid is pumped under pressure from a fluid reservoir (not shown) to inlet opening 64 in the doctor blade assembly. From there, coating spreads over the engraved surface of roller 12 and is metered by the engraving and by doctor blade 26. A continuous flow of coating is maintained over the surface of roller 12, and excess coating is recovered through drip pan 66 and outlet 68 for recycling. In this way, sufficient flow is maintained to avoid clogging the flow path or roller with dried coating and to avoid starving the ends of the roller. The amount of coating carried by roller 12 can be adjusted by turning screw 28 to adjust the pressure between blade 26 and roller 12, as described above. When the press is on impression, hydraulic cylinders 50 serve to pull roller 12 against blanket roller 112 with a force that can be adjusted by adjusting the pressure in cylinders 50. As blanket rotates in direction R, friction turns roller 12 in the opposite direction R', without assistance from the motor 72.

As blanket roller 112 rotates, the indentation 126 on that roll encounters the nip between roller 12 and roller 112. It is undesirable to allow roller 12 to be forced into that indentation 126 by hydraulic cylinders 50. Stops 56 are adjusted to limit travel of coater housing 16 and prevent that from occurring. Stops can be finely adjusted to set the optimum pressure (for example about 40–50 pounds/linear inch) between roller 12 and roller 112.

A metered amount of liquid coating is delivered to blanket roller 112 at the nip between roller 112 and roller 12. Blanket roller 112 in turn delivers that coating to the workpiece as the workpiece travels through the nip between roller 112 and impression roller 114.

When the coater is not in use, latch 54 is released, and the coater is moved back along rods 44 away from roller 112.

More specifically, when using an acrylic water-based coating, a suitable engraved roller is a quadrangular cell cylinder, having about 165 lines/inch, each cell being about 60 microns in depth. Machine Engraving Division. Southern Gravure Service, Inc., Louisville, Ky., sells a suitable engraved roller. An acrylic water-based coating having about 25% solids can be applied to

achieve a dry coat weight of 0.6–0.9 pounds using a roll speed of about 350 rpm.

OTHER EMBODIMENTS

Other embodiments are within the following claims. For example, other doctor blade arrangements can be used to meter the load on roller 12; such as a system having dual, parallel blades having a coating inlet between the two blades. Other types of engraved cylinders may be used. Other types of press units may be used in conjunction with the coater, but offset lithographic sheet-feeding units are preferred.

I claim:

1. Apparatus for applying a liquid coating to the surface of a sheet workpiece, said apparatus being adapted for operation on-line with the last unit of a lithographic sheet printing press, said unit comprising a blanket roller having a surface indentation, said coating application apparatus comprising:

(1) a metering roller rotatably mounted in mounting means, said metering roller having a textured longitudinal surface, said mounting means being linearly movably attached to a support platform fixed adjacent said last press unit, and extending between the last press unit and a point remote from said unit, allowing movement of said metering roller and said mounting means between a first position in which said mounting means is continuously adjustably biased against said last press unit wherein said metering roller surface contacts said blanket roller, and a second position, away from said last press unit to allow use of said last press unit as a lithographic press, said platform comprising longitudinal supports arranged generally perpendicular to a vertical plane through the axis of said metering roller, said metering roller mounting means being supported by, guided by and movable along said supports;

(2) latch means, attached to the mounting means and positioned to lock said metering roller mounting means to said press unit in said first position, said latch means comprising a biasing means to adjustably bias said metering roller mounting means against said press unit, providing a steady even pressure between said blanket roller and said metering roller, wherein said mounting means further comprises a continuously adjustable stop to position said metering roller against said blanket roller and to prevent travel of said metering roller toward said surface indentation of said blanket roller as said blanket roller rotates, said latch being movable to provide quick release of said mounting means from said press unit to allow movement along said supports to said second position; and

(3) a metering member comprising means to control liquid coating on said textured metering roller surface;

(4) means attached to said mounting means to supply liquid coating material to the textured surface of said metering roller; and

(5) means attached to said mounting means to effect rotation of said metering roller;

whereby in said first position, said metering roller continuously delivers a smooth, uniform, metered amount of said liquid material to said blanket roller, said blanket roller transferring said liquid material to said sheet workpiece, said latch allowing said mounting means, with its attached metering roller, liquid coating supply means, and metering roller rotation means, to be readily detached from and moved out of the way of the press unit, so that the press unit can be used as a lithographic press unit, and said latch means and adjustable stop allowing said metering roller and mounting means to be readily and reliably returned,locked and biased in the same said first position.

2. The apparatus of claim 1 wherein said metering member comprises a doctor assembly, said assembly comprising an elongated blade edge positioned against said textured roller surface, said assembly further comprising said means to deliver said liquid coating material to said textured roller surface.

3. The apparatus of claim 1 wherein said latch means comprises a cylinder attached to said mounting means that adjustably forces said mounting means against said press unit.

4. The apparatus of claim 1 wherein said longitudinal supports comprise rail members, and said mounting means comprises bearings that slide along said rail members.

5. The apparatus of claim 2 comprising a drip pan positioned below said doctor assembly attached to said mounting means, said drip pan comprising an outlet to drain and recirculate excess liquid coating material that flows from the ends of said metering roller, said doctor assembly comprising means to hold said elongated blade and adjust the blade pressure against the metering roller, said liquid coating delivery means comprising a centrally positioned outlet to deliver coating recirculated from said drip pan.

6. The apparatus of claim 3 wherein said latch means comprises a lug mounted on said press unit positioned to cooperate with said cylinder, said cylinder being a hydraulic cylinder, said latch further comprising a quick-release interconnect between said lug and said cylinder.

7. The apparatus of claim 6 wherein said latch means comprises a pivoting member that pivots between a first position attached to said lug and a second position that releases said coater from said press unit.

8. The apparatus of claim 7 wherein said latch means comprises a hook member configured to pivotally engage said lug on said press unit.

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